

The University of Maine DigitalCommons@UMaine

Electronic Theses and Dissertations

Fogler Library

Summer 8-22-2019

The Effect of Public-Place Smoking Bans on Risky Health Behavior among different Races and Ethnicities in the United States

Muntasir Rahman

university of maine, muntasir.rahman@maine.edu

Follow this and additional works at: <https://digitalcommons.library.umaine.edu/etd>



Part of the [Econometrics Commons](#), and the [Health Economics Commons](#)

Recommended Citation

Rahman, Muntasir, "The Effect of Public-Place Smoking Bans on Risky Health Behavior among different Races and Ethnicities in the United States" (2019). *Electronic Theses and Dissertations*. 3078.

<https://digitalcommons.library.umaine.edu/etd/3078>

This Open-Access Thesis is brought to you for free and open access by DigitalCommons@UMaine. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of DigitalCommons@UMaine. For more information, please contact um.library.technical.services@maine.edu.

**THE EFFECT OF PUBLIC-PLACE SMOKING BANS ON RISKY HEALTH BEHAVIOR AMONG
DIFFERENT RACES AND ETHNICITIES IN THE UNITED STATES**

By

Muntasir Rahman

BSS in Economics, East West University, 2011

MSS in Economics, East West University, 2016

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(in Economics)

The Graduate School

The University of Maine

August 2019

Advisory Committee:

Angela Daley, Assistant Professor of Economics, Advisor

Mario Teisl, Professor of Economics

Caroline Noblet, Associate Professor of Economics

THE EFFECT OF PUBLIC-PLACE SMOKING BANS ON RISKY HEALTH BEHAVIOR AMONG DIFFERENT RACES AND ETHNICITIES IN THE UNITED STATES

By Muntasir Rahman

Thesis Advisor: Dr. Angela Daley

An Abstract of the Thesis Presented
in Partial Fulfillment of the Requirements for the
Degree of Master of Science
(in Economics)

August 2019

There is an established body of literature on the effect of public-place smoking bans on smoking behavior. However, these studies focus on the effect of the public-place bans on the overall population and ignore racial/ethnic heterogeneity, therein. Given that there is ample evidence of racial/ethnic differences in risky health behaviors (such as smoking and drinking) in the United States, research that sheds light on this differential impact is necessary. Thus, the two studies presented in this thesis work estimates the heterogeneous racial/ethnic effects of public-place smoking bans on smoking and drinking related behavior of U.S. adults.

In the first chapter we estimate the effect of public-place smoking bans on drinking behavior in the United States (i.e. probability of drinking, number of drinks, binge drinking occasions and instances of drunk driving) by testing for heterogeneity across those who identify as American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Asian, Black/African American and Hispanic/Latinx, respectively. There is a small body of literature on the effect of public-place smoking bans on alcohol consumption, given the complementarity between

smoking and drinking. We extend this literature by considering differences across ethnic subgroups. The data for this study comes from the Behavioral Risk Factor Surveillance System (2002-2014), which is a nationally representative survey of adults in the United States. Our sample consists of 453,898 individuals living in the 36 states (including Washington DC) covered by state-wide public-place bans. We use a difference-in-differences model to exploit variation in the timing of the bans across states. Results are presented separately by gender. Our findings suggest that bans have a differential impact across racial/ethnic subgroups, with Black/African American and Hispanic/Latinx men and women experiencing most of the impact.

In the second chapter, we again use data from the Behavioral Risk Factor Surveillance System (2002 to 2012) to assess the racial/ethnic heterogeneous effect of the public-place smoking bans on smoking behavior. Our sample consists of 8,210 pregnant women across all 50 states (as well as Washington DC) who self-identify as White, Black/African American, Asian and Hispanic/Latinx. We do so by applying the difference-in-differences model and testing for heterogeneity across these races/ethnicities for five outcome variables: current versus former smokers; daily versus occasional smokers; occasional versus former smokers; daily versus former smokers and whether the respondent attempted to quit smoking. The results are presented separately by educational attainment level (low of high educational attainment). The results show that, while there is no significant effect of the bans when looking at the population as a whole, differences exist across racial/ethnic subgroups. The estimates suggest that the bans have led to worsening smoking behavior among Hispanic/Latinx women from the low education group while there were improvement (or no change) across women in the high education group.

Both of these studies show the importance of disaggregating the impact of public-place smoking bans and similar policies by race/ethnicity to better understand the heterogeneity therein. The results also suggests that further research explaining the reason behind these differences is required.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank Dr. Angela Daley, my advisor extraordinaire. Angela, you have been an incredible mentor throughout my graduate life and have given me more opportunities for growth as a researcher, scholar and professional than I ever had the right to expect. I can honestly count myself privileged to have worked with you and I thank my lucky stars that our first Skype interview went as well as it did! I fervently hope that we can still collaborate in future works. I would also like to thank my two committee members - Dr. Mario Teisl and Dr. Caroline Noblet. Both of you have been invaluable as thesis advisors and conversations with you both over the past two years have expanded my understanding of economics and the world. My heartfelt gratitude goes to my Fall'18 cohort, without whom grad-life would have been much more daunting. Amy Bainbridge, Jonathan Gendron, Olga Bredikhina and Avery Cole- I couldn't ask for a better support group! I think we did pretty alright together in the end! I hope you all go on to do wonderful things in your life. I must also show my appreciation for the School of Economics. I could not have asked for a better and more supportive department. I would also like to thank my roommates, Ram T., Suriya L., and William R., my travel buddies across the US! Finally, I am very grateful to my Mom, Dad and sister back home for their unconditional support for the past two years. I just hope you realize that the next five years are going to be tougher!

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ii
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS.....	viii
1. INTRODUCTION	1
1.1. Introduction.....	1
1.2. Purpose and objective of the research	2
1.3. Thesis outline	3
2. THE EFFECT OF PUBLIC-PLACE SMOKING BANS ON DRINKING BEHAVIOR AMONG DIFFERENT RACES AND ETHNICITIES IN THE UNITED STATES	4
2.1. Introduction.....	4
2.2. Literature Review	5
2.2.1. Relationship between smoking and drinking	5
2.2.2. Ethnic differences in smoking and drinking	7
2.2.3. Smoking Cessation Policies and its effect on Alcohol Consumption	9
2.2.4. Theoretical framework and hypothesis.....	11

2.3. Methods	12
2.3.1. Data.....	12
2.3.2. Econometric Model	14
2.4. Results	17
2.4.1. Descriptive statistics	17
2.4.2 Regression estimates of racial/ethnic group differences.....	21
2.4.3. The effect of public-place smoking bans on outcomes.....	25
2.5. Discussion	28
2.6. Limitations.....	29
3. THE EFFECT OF PUBLIC-PLACE SMOKING BANS ON SMOKING BEHAVIOR AMONG PREGNANT WOMEN OF DIFFERENT RACES AND ETHNICITIES IN THE UNITED STATES	31
3.1. Introduction.....	31
3.2. Literature Review	32
3.2.1. Predictors of prenatal smoking	32
3.2.2. Effects of prenatal smoking.....	33
3.2.3. Smoking cessation policies	35
3.2.4. Theoretical framework for smoking behavior in the household	37
3.3. Methods	38
3.3.1. Data.....	38

3.3.2. Econometric model	40
3.4. Results	41
3.4.1. Descriptive statistics	41
3.4.2. Regression estimates of racial/ethnic group differences.....	44
3.4.3. Effects of public place smoking-bans on different ethnicities	48
3.5. Discussion	50
3.6. Limitations	52
4. CONCLUSIONS.....	533
REFERENCES.....	577
APPENDIX	666
BIOGRAPHY OF THE AUTHOR	688

LIST OF TABLES

Table 2.1.	Descriptive statistics of sample, by gender	18
Table 2.2.	Effect of public-place smoking bans on drinking outcomes, male	26
Table 2.3.	Effect of public-place smoking bans on drinking outcomes, female	27
Table 3.1.	Descriptive statistics of sample, by educational attainment.....	42
Table 3.2.	Effect of public-place smoking bans on smoking outcomes, low educational attainment	49
Table 3.3.	Effect of public-place smoking bans on smoking outcomes, high educational attainment	50
Table A.1.	The marginal effects of the bans, low educational attainment	66
Table A.2.	The marginal effects of the bans, high educational attainment	67

LIST OF FIGURES

Figure 2.1. Summary of dependent variables, by race/ethnicity and gender.....	20
Figure 2.2. Comparing whether respondent drank in the past month or not, by race/ethnicity.....	22
Figure 2.3. Comparing number of drinks in the past month, by race/ethnicity.....	23
Figure 2.4. Comparing binge drinking occasions in the past month, by race/ethnicity	24
Figure 2.5. Comparing drunk driving instances in the past month, by race/ethnicity.....	25
Figure 3.1. Types of smokers by race/ethnicity and education.....	44
Figure 3.2. Comparing current versus former smokers, by race/ethnicity	45
Figure 3.3. Comparing daily versus occasional smokers, by race/ethnicity	46
Figure 3.4. Comparing occasional versus former smokers, by race/ethnicity	46
Figure 3.5. Comparing daily versus former smokers, by race/ethnicity	47
Figure 3.6. Comparing attempted to quit or not, by race/ethnicity.....	47

LIST OF ABBREVIATIONS

ANSRF - American Nonsmokers' Rights Foundation

BRFSS - Behavioral Risk Factor Surveillance System

CDC - Centers for Disease Control and Prevention

CTCA - Cancer Treatment Centers of America

DD - Difference-in-differences

DUI - Driving Under the Influence

NHTSA - National Highway Traffic Safety Administration

NIAAA - National Institute on Alcohol Abuse and Alcoholism

NSDUH - National Survey on Drug Use and Health

SAMHSA - Substance Abuse and Mental Health Services Administration

SES - Socio-economic Status

USDHHS - United States Department of Health and Human Services

ZINB - Zero Inflated Negative Binomial

CHAPTER 1

INTRODUCTION

1.1. Introduction

The wide prevalence of smoking and the extent of its associated health outcomes make tobacco one of the most important public-health concerns all over the world (Mokdad et al., 2005; Reitsma et al., 2017). Smoking not only affects the health of the smoker, but also others exposed to second-hand smoke. The same is true for smoking during pregnancy, as it also affects the health of the child in utero and has long-lasting repercussions (Agrawal et al., 2010; Lumley et al., 2004). As a result, smoking imposes high economic and social costs, and so governments around the world have enacted more progressive tobacco control policies over the decades, with mixed results (Adda & Cornaglia, 2010; Been et al., 2015; Carpenter et al., 2011). These policies have included tobacco taxation, access restriction and smoking bans and advertising regulations.

Evidence show that there is a relationship between smoking and drinking and these substances reinforce the addictive nature of each other (Barrett et al., 2006; Sharma et al., 2015). Based on this, we assess how the public-place smoking bans enacted at the state-level have affected drinking behavior across racial/ethnic subgroups in the United States. In addition, given that pregnant women are particularly vulnerable to smoking related morbidities, we also assess how the public-place bans have affected their smoking behavior during pregnancy.

1.2. Purpose and objective of the research

The contribution of this work lies in the fact that prior research into the effect of publicplace smoking bans on risky-health behaviors (i.e. smoking and drinking) have generally ignored racial/ethnic heterogeneity. We know that the prevalence of these risky health behaviors differ substantially across racial/ethnic subgroups (Substance Abuse and Mental Health Services Administration (SAMHSA), 2018), therefore, it is important that studies assess the differential impact of the bans on these subgroups. Moreover, the effect of public-place smoking bans on drinking behavior is not well understood in the literature.

In the first study, our objective is to estimate the effect of the public-place smoking bans on four drinking-related outcomes: (1) the likelihood of drinking in the past month; (2) the number of drinks consumed in the past month; (3) the number of binge drinking occasions in the past month; and (4) the likelihood of engaging in drunk driving in the past month. In doing so, we test for heterogeneity across those who identify as American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Asian, Black/African American and Hispanic/Latinx, respectively.

In the second study, our objective is to estimate the effect of the public-place smoking bans on the likelihood of pregnant women being: (1) current versus former smokers; (2) daily versus occasional smokers; (3) occasional versus former smokers; (4) daily versus former smokers; and (5) whether the respondent attempted to quit smoking.

1.3. Thesis outline

The remainder of this thesis paper will be divided into two studies, both looking at the effect of public-place smoking bans on drinking behavior (chapter 2) and smoking behavior among pregnant women (chapter 3), across racial/ethnic subgroups. Chapter 2 uses data from the Behavioral Risk Factor Surveillance System (2002-2014), which is a nationally representative survey of adults in the United States. Chapter 3 uses the same data source (2002 to 2012), but the samples are restricted to only pregnant women who are either current or former smokers. Chapter 4 discusses the takeaways from both the chapters to conclude the thesis.

CHAPTER 2

THE EFFECT OF PUBLIC-PLACE SMOKING BANS ON DRINKING BEHAVIOR AMONG DIFFERENT RACES AND ETHNICITIES IN THE UNITED STATES

2.1. Introduction

Alcohol and tobacco remain two of the top causes of preventable deaths in the United States (Mokdad et al., 2005) and are often linked with major health risks when used alone or together. An estimated 88,000 people die from alcohol related causes annually (NIAAA, 2015). Alcohol is associated with chronic liver disease, cardiovascular disease, acute alcohol toxicity, fetal alcohol syndrome as well as traumatic death and injury (e.g. drunk driving made for about 31% of all driving related fatalities in the U.S. in 2014)(NIAAA, 2015). Some 80 percent of throat and mouth cancer in men and 65 percent in women may be linked to the combination of smoking and drinking (CTCA, 2018) . Excessive drinking cost the U.S. some \$249 billion in 2010 stemming from reduced workplace productivity, crime, and the cost of treating people for health problems caused by excessive drinking; of this, 77% was due to binge drinking (Sacks et al., 2015). The U.S. government paid over \$100 billion of this total cost. Sacks et al. (2015) also mention that these values are most likely underestimated as the study does not include other indirect costs such as the pain and suffering (e.g. intimate partner violence) associated with excessive alcohol consumption. On the other hand, smoking is responsible for more than 480,000 deaths annually in the U.S. including 41,000 deaths from second-hand smoke exposure (CDC, 2014). This costs the U.S. some \$300 billion per year including \$170 billion for direct medical care and \$156 billion in lost productivity (Xu et al., 2015).

A large scale prevalence study by the National Institute on Alcohol Abuse and Alcoholism¹ has shown that some 46 million adults (or 21.7% of adults) in the U.S. used both alcohol and tobacco products in 2002, with 4.6 million of them reporting both alcohol use disorders and concurrent nicotine addiction (Saha et al., 2006). In 2014, the number of concurrent smokers and drinkers had reduced to 26 million adults, which is still a sizeable number (Gallup, 2014). While this and other studies (Barrett et al., 2006) have established the link between smoking and drinking habits, there is also evidence that smoking and drinking habits vary by ethnicity in the U.S. (Ellickson et al., 2004; Falk et al., 2006; Jamal et al., 2015). Therefore, when assessing the effect of public-place smoking bans, it is pertinent to explore indirect effects on drinking behavior and to consider racial and ethnic heterogeneity therein. In order to do so, in this paper we attempt to analyze how the public-place smoking bans have affected drinking related behaviors (the likelihood of respondents drinking in the past month, number of drinks in the past month, number of binge drinking occasions in the past month and drunk driving in the past month) across ethnicities and races in the U.S.

2.2. Literature Review

2.2.1. Relationship between smoking and drinking

There have been many biological and genetic studies that have looked at why tobacco and alcohol use co-occur so frequently. Biological studies have shown that nicotine in tobacco increases the craving for alcohol in concurrent users (Barrett et al., 2006). On the other hand, drinking alcohol enhances the pleasure gained from smoking cigarettes (Rose et al., 2004).

¹ This study is one of the largest comorbidity studies ever conducted in the United States.

Thus, tobacco and alcohol reinforces the addictive nature of each other. Concurrent usage also builds up addictive tolerance for each substance (Funk et al., 2006). However, there is evidence showing that if nicotine receptors in the brain are blocked (e.g. by reducing smoking), people not only tend to consume less nicotine, but also less alcohol (Corrigall et al., 1994; Söderpalm et al., 2000).

These findings are consistent with evidence on the association between excessive alcohol consumption and smoking intensity. For instance, in a study of young adults aged 18 to 25 in the U.S., Gubner et al. (2016) found that people who binge drank tended to smoke more cigarettes compared to non-binge drinkers. Similarly, adolescent smokers in the U.S. are more likely to be binge drinkers compared to non-smokers (Johnson et al., 2000).

In addition to the biological/genetic approach to understanding the relationship between tobacco and alcohol use, researchers have used an economic approach by considering cross-price elasticity (i.e. how tobacco consumption responds to changes in alcohol price and vice versa). Decker and Schwartz (2000) found significant cross-price elasticity between cigarettes and beer in the U.S., with estimates showing higher beer prices decreasing both beer consumption and smoking. This implies complementarity. A German study also assessed whether tobacco and alcohol were complements using parental consumption of alcohol as an instrumental variable for individual alcohol consumption. Their research suggests that tobacco and alcohol are complements for males but no significant results were found for females (Tauchmann et al., 2013). A longitudinal study in the U.S. finds that increases in cigarette taxes was associated with a modest decrease in the quantity of yearly alcohol consumption (a 11 percent reduction) and binge drinking (22 percent fewer occasions) among smokers, though it

was not associated with any decline among non-smokers (Young-Wolff et al., 2014). Another study in Taiwan looked at the effect of an increase in the taxation on cigarettes and found that doubling the cigarette tax from NT\$5 to NT\$10 reduced alcohol consumption by 7.5 percent (Lee, 2007). Similarly, complementarity between cigarette price and alcohol demand was also shown in an Italian study, though the strength of cross-price elasticity was higher between alcohol prices and cigarette demand rather than the other way around (Pierani & Tiezzi, 2009).

2.2.2. Ethnic differences in smoking and drinking

In the United States, alcohol and tobacco use vary by gender and race/ethnicity. The 2017 National Survey on Drug Use and Health reported that 40.5% of American Indian/Alaska Native adults smoked cigarettes in the past month, followed by Native Hawaiian/Pacific Islanders (24.2%), Black/African Americans (21.4%), Whites (20.0%), Hispanic/Latinx (16.0%) and Asians (8.6%)(Substance Abuse and Mental Health Services Administration (SAMHSA), 2018). The report also shows that binge drinking varies by race/ethnicity, with 29.6% American Indian/Alaska Native adults having binge drank at least once in the past month, followed by Hispanic/Latinx (28.6%), Native Hawaiian/Pacific Islanders (28.2%), Whites (27.3%), Black/African Americans (24.9%) and Asians (14.2%) (Substance Abuse and Mental Health Services Administration (SAMHSA), 2018).

When it comes to the concurrent use of alcohol and tobacco, men report higher rates of concurrent use than women (27.5% and 16.4%, respectively) (Anthony & Echeagaray-Wagner, 2000). Likewise, the prevalence of concurrent alcohol and tobacco use was highest among American Indian/Alaska Natives (34% among men and 24% among women), followed by Whites

(29.4% and 18.2%), Black/African American (24.8% and 12.6%), Hispanic/Latinx (20.5% and 11.3%) and Asian/Native Hawaiians/Pacific Islanders² (18.1% and 6.6%) (Falk et al., 2006). When it comes to ethnic differences in binge drinking, Native Hawaiians/ Pacific Islanders have the highest prevalence (24.7%), followed by Hispanics/Latinx (24.1%), Whites (24%), Blacks/African Americans (20.1%) and Asians (12.4%) (NSDUH, 2014). There are ethnic differences in the rates of drunk driving as well. Statistics on driving under the influence (DUI) show that 15.6% of Whites and 13.3% of Native Americans/Alaska Natives reported DUIs in the past year, followed by Blacks/African Americans (10%), Hispanics/Latinx (9.3%), and Asians (7.0%) (Chartier & Caetano, 2010).

Since the rate of alcohol consumption and binge drinking vary by race/ethnicity (both separate and concurrent use), the negative impacts also vary. For instance, a study looking at disparities in alcohol-related problems among White, Black/African American and Hispanic/Latinx Americans found that among heavy drinkers, Blacks/African Americans were around 5.7 times more likely to be at risk of developing alcohol dependence symptoms compared to Whites, while Hispanics/Latinx were around 3.7 times more likely (Mulia et al., 2009). The study also explored possible factors that might be associated with these disparities, which include living in greater poverty and reporting higher levels of racial/ethnic stigma. Another study has found that Native Americans/Alaska Natives have greater odds than Whites of lifetime alcohol dependence (Hasin et al., 2007). In addition to differences across racial and ethnic groups, there are disparities within each group. For instance, among the Hispanic/Latinx

² Historically, the U.S. Census merged individuals who identified as Asian and Native Hawaiians/Pacific Islanders. More recently this practice has changed and in this paper, Asians and Native Hawaiian/Pacific Islanders are reported separately.

subgroup, Puerto Ricans are the most likely to develop lifetime alcohol abuse and dependence (7.1% abuse and 5.5% dependence), followed by Mexican Americans (6.0% and 4.7%) and Cuban Americans (3.1% and 2.4%) (Alegría Margarita et al., 2008). By gender, Puerto Rican (15.3%) and Mexican American (15.1%) men have higher rates of alcohol dependence than South/Central American (9.0%) and Cuban American (5.3%) men. Moreover, among Hispanic women, Puerto Ricans (6.4%) had higher rates relative to Mexican (2.1%), Cuban (1.6 percent), and South/Central Americans (0.8%) (Caetano et al., 2008). Similar differences also exist within the Asian ethnic group in the U.S. with Filipino Americans having the highest rate of alcohol related disorders (20.2%), followed by Chinese (10.3%) and Vietnamese (2.5%) (Chae et al., 2008).

2.2.3. Smoking Cessation Policies and its effect on Alcohol Consumption

While there is a well-established literature on how public-place smoking bans affect smoking ³ (Anger et al., 2011; Carpenter et al., 2011; Owyang & Vermann, 2012; Tauras et al., 2013), there have been few studies looking at the link between public-place smoking bans and alcohol consumption. For instance, a paper looking at the effect of public place smoking bans in bars across countries (UK, Australia, Canada and the U.S.) found that even if the policy did not reduce smoking behavior, it led to small reductions in alcohol consumption among those classified as hazardous drinkers (Kasza et al., 2012) ⁴. Another study conducted in the U.S.

³ Most of these studies have found that smoking bans have little effect on smoking behavior, but reduce exposure to second-hand smoking in public places, without significant displacement (i.e. from public places to private places, such as homes)

⁴ Hazardous drinking is defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) criteria.

looked at the determinants of state-level alcohol demand and concluded that smoking bans in bars and restaurants altered consumer demand for alcohol, leading to a reduction in beer and spirits consumption, but a rise in wine consumption (Gallet & Eastman, 2007). Another study by Koxsal and Wohlgenant (2015) found that public-place smoking bans may not necessarily reduce alcohol consumption. Their results suggest that smokers reduced smoking but increased drinking in restaurants and bars, while reducing drinking at home (Koxsal & Wohlgenant, 2016). Picone et al. (2004) used smoking bans and cigarette prices to analyze the effect on alcohol consumption. They found that there is indeed a reinforcement effect of past smoking with current alcohol consumption, and that public-place smoking bans reduce consumption of alcohol (Picone et al., 2004).

Evidence on whether the public-place smoking bans have reduced drunk driving is scarce and the few studies that have been conducted give mixed results. For instance, Adams and Cotti (2008) used geographic variations in local and state wide public-place smoking bans in bars in the U.S. to estimate if there had been an increase in fatal accidents involving drunk driving. They found that there was an increase in the number of accidents involving drunk driving and they hypothesize that the reason might be because smokers were driving longer distances to cross local or state borders to go to bars that did not have such smoking bans. On the other hand, Bernat et al. (2013) analyzed this association by looking at alcohol-related car crashes in New York and California after statewide smoking bans in restaurants and bars were implemented. Their results showed no significant increase in alcohol-related fatalities from car crashes as a result of the bans, not even near state borders (Bernat et al., 2013).

2.2.4. Theoretical framework and hypothesis

While there can be many different reasons for people from different races/ethnicities to be more (or less) receptive to policies targeting risky health behaviors (such as smoking and drinking), a strong argument can be made for linking it to the existence of ethnic enclaves and the theory of collective efficacy. Ethnic enclaves are geographical locations with a high concentration of a particular racial/ethnic group. While it is clear that ethnic enclaves do exist in the U.S. (IPFS, n.d), there is no clear measure for the strength or spread of such enclaves in the country. An indirect measure of the strength of ethnic enclaves may be the dissimilarity index (which is a measure of the evenness of the distribution of two racial/ethnic groups across a geographical area). In a study comparing how segregated a particular race/ethnicity of people are in relation to Whites, Iceland and Sharp (2013) found that Blacks/African Americans are the most segregated, followed by Hispanics/Latinx and Asians in U.S. metropolitan areas.

This concept of ethnic enclaves is closely linked to the theory of collective efficacy posited by Sampson in 1997. This theory focuses on the functioning of a neighborhood and links it to positive (or negative) outcomes in the neighborhood through shared trust and cohesion among residents. This, in essence, is an informal method of regulating unwanted behaviors such as smoking and binge drinking (Sampson et al. 1997). Following this theory, researchers have found, for instance, that neighborhoods with strong collective efficacy are better able to control unwanted behavior such as youth drinking (Maimon & Browning, 2012; Fagan et al., 2014). In the absence of strong collective efficacy and relaxed neighborhood norms regarding risky health behaviors, binge drinking may actually increase (Ahern et al., 2008).

Thus, we hypothesize that certain races/ethnicities may be more receptive to the ban policy than others, and the notions of ethnic enclaves and, by association, collective efficacy play a big role in determining how receptive different races/ethnicities are to a policy.

In essence, the existing literature related to smoking bans and drinking seems to suggest that there is a positive impact of such policies in general. However, since there haven't been many studies on this particular area, policy makers and others may argue that the evidence is not strong enough to reach a certain conclusion regarding the effects of public-place smoking bans and drinking habits. Many of the studies cited need to be more econometrically rigorous and wider in their scope (both in terms of sample size, demography and geography). None of the literature differentiates their sample by race/ethnicity. As the literature on alcohol consumption disparity show quite distinct differences among racial/ethnic subgroups (and even within each subgroup), there is a need to study the differential impact of such a policy. Our paper aims to address some of these limitations in prior studies by assessing the racial/ethnic heterogeneity of public-place smoking bans on drinking behavior using a large, nationally representative dataset and a well-established econometric model.

2.3. Methods

2.3.1. Data

We use repeated annual cross-sectional data from the Behavioral Risk Factor Surveillance System (BRFSS), ranging from 2002 to 2014. The BRFSS is a nationally representative annual survey of adults in the United States, collected by the Centers for Disease Control and Prevention.

From 2002 to 2010, data were collected using a disproportionate stratified sampling design. Here, the BRFSS divided landline telephone numbers into three strata: high, medium and low density. The high-density and medium-density strata consisted of telephone numbers that were expected to contain a large proportion of households. The low-density stratum consisted of telephone numbers that were expected to contain a small proportion of households (BRFSS, 2002). The high-density and medium-density stratum were sampled at a higher rate than the low-density stratum to obtain a sample that contained a larger proportion of telephone numbers than would be the case if all numbers were sampled at the same rate. These samples were weighted so that each response counted the same way as any other response. The final weight assigned to each respondent is defined by: (1) the design weight, which incorporates the probability of falling into each of the three strata, and adjusts for nonresponse and non-coverage bias; and (2) demographic adjustment of the population, where the number of people is sampled to some known proportion of age, ethnicity, sex and geographic region for each state (post stratification). The sampling design changed slightly from 2011 onward as the BRFSS incorporated cell phone numbers in addition to landlines. Another change was in the weighting method to adjust to possibility of a household having more than one phone (BRFSS, 2011). It also allowed for the introduction of additional demographic variables (e.g. such as education level, marital status and home-ownership) into the post-stratification adjustment process.

Our sample consists of adults living in the 36 states that enacted a 100 percent public place smoking ban during the study period⁵. My estimating sample consists of 453,898 individuals in the relevant states. As part of the data cleaning process, I dropped samples that had data missing related to my variables of interest. The data on smoking bans come from the American Nonsmokers' Rights Foundation (ANSRF), an organization that maintains records of states and municipalities with laws to limit smoking in workplaces, restaurants, bars and gambling facilities (ANSRF, 2018). Records include the timing and the extent of such bans. In 2002, Delaware became the first state to have a 100% public-place smoking ban and by 2014, public-place bans covered 36 states (including DC) and affected around 81.8% of the U.S. population (ANSRF, 2018). We use data on beer tax across states as a proxy for alcohol price (Freeman, 2000; Markowitz et al., 2005; Ruhm, 1996) using information from the Tax Foundation, an organization that compiled the dollar value of taxation per gallon of beer (Tax Foundation, 2019)⁶.

2.3.2. Econometric Model

In this paper, we use the negative binomial, zero inflated negative binomial and probit regression models to estimate the effect of our dependent variables. Each of these models can be loosely expressed in general as:

⁵ We do not consider bans at lower spatial scales because the publicly available BRFSS survey data does not contain geographical information below the state level.

⁶ Good data on alcohol price is difficult to find since past studies used the price of a representative brand of alcoholic beverage, which may not be representative of the typical drinker (Young & Bielinska-Kwapisz, 2003) or used proprietary data (such as Uniform Product Barcode). Tax amount is often used as a proxy for price, but some states control the distribution of liquor and so data is unavailable for some alcoholic beverages.

$$Prob(outcomes_{ist} = y_{ist}) = F(\hat{\beta}X_{ist})$$

where, $outcomes_{ist}$ are the four drinking related independent variables, X_{ist} is the set of explanatory variables and $\hat{\beta}$ the coefficient estimates.

In particular, and similar to the identification strategy used by Carpenter et al. (2011) and Adda & Cornaglia (2010), we identify the effect of public-place smoking bans on drinking habits and drunk driving using a difference-in-differences approach by exploiting variation in the timing of the bans across states. The estimating equation is:

$$Y_{ist} = \beta_0 + \beta_1 \sum_{i=1}^5 RaceEthnicity_i + \beta_2 Ban_{st} + \beta_3 \sum_{j=1}^5 (Ban_{st} * RaceEthnicity_i) + \beta_4 X_{ist} + \beta_5 Z_{st} + State_s + Year_t + \epsilon_{ist} \quad (1)$$

For an individual i in state s and time period t , Y_{ist} represents one of the four outcomes of interest in our study: (1) likelihood of the respondent drinking in the past month; (2) likelihood of engaging in drunk driving in the past month⁷; (3) number of drinks in the past month; and (4) number of binge drinking occasions in the past month⁸.

$RaceEthnicity_i$ indicates whether the individual self-identified as American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Asian, Black/African American or Hispanic/Latinx. The base group is White or other. Ban_{st} captures whether the individual was affected by a ban. β_2 is the difference-in-differences (DD) estimator indicating the average effect of the bans on the omitted category, while β_3 reflects differences across racial/ethnic

⁷ This question was only asked in the 2002, 2003, 2004, 2006, 2008, 2010, 2012 and 2014 BRFSS survey.

⁸ Binge drinking is defined as having 5 or more drinks on an occasion for men, and 4 or more drinks for women.

minorities. X_{ist} contains individual characteristics, including age, marital status, education and real income. Z_{st} contains time-varying state characteristics, such as unemployment rates, attitudes toward smoking and real cigarette prices. $State_s$ and $Year_t$ are state and time fixed effects. ε_{ist} is the error term.

The ‘likelihood of drinking in the past month’ outcome is binary and thus is estimated using the probit regression. This model does not account for whether the respondent has a zero because they are not drinkers or because they did not drink in the past month. This distinction is taken into account for the ‘number of drinks in the past month’ variable which consists of count data. After running diagnostic checks on the nature of its distribution, we opted to use a zero inflated negative binomial regression (ZINB) model⁹. Similarly we use a negative binomial regression for the outcome variable ‘number of binge drinking occasions in the past month’¹⁰. Lastly, given the binary nature of the ‘likelihood of engaging in drunk driving in the past month’, we estimate the model using a probit regression. For each outcome, equation 1 is measured separately by gender. Robust standard errors are clustered by state and normalized sampling weights are used in all regressions.

The DD estimator shows the effect of the public-place smoking bans on the full sample. When the DD estimator is interacted with each of the racial/ethnic subgroups, it shows how the ban affects each of these races/ethnicities in excess (either positive or negative) of the average

⁹ The data were over-dispersed and the nature of the question meant that there were respondents answering ‘zero’ because they genuinely did not drink in the past month, as well as respondents with a ‘zero’ because they do not consume alcohol at all. The Vuong test confirmed the presence of an inflated number of ‘zeros’.

¹⁰ The data were over dispersed as well, but did not contain an inflated number of zeros because the question was only asked to people who had had at least one drink in the past month. This means that all ‘zeros’ were meaningful.

effect on the omitted category. The results for the four separate outcome variables are reported slightly differently for ease of interpretation. Specifically, two of the models are binary in nature, so estimates are reported as average marginal effects. The other two models are count data, and the estimates are presented as exponentiated values of the original coefficients derived from the ZINB and negative binomial regressions, respectively¹¹. These results can be interpreted as factors¹².

2.4. Results

2.4.1. Descriptive statistics

The descriptive statistics of our sample are shown in Table 2.1. The sample consists of more women (56.1%) than men. The five races/ethnicities we consider make up 21.6% of the total sample, with Hispanics/Latinx (9.94%) and Black/African Americans (8.71%) making up a majority, followed by Asians (2.67%), American Indians/Alaska Natives (0.89%) and finally Native Hawaiian/Pacific Islanders (0.25%). The rest of the sample is made up of majority Whites alongside mixed races/ethnicities and 'other' races/ethnicities. The average age is 46 years, a large portion of men and women have a college degree (35.8% and 35% of men and women, respectively), are part of a married or unmarried couple (66.1% and 60.3%) and in the highest income category (52.9% and 46.8%).

¹¹ As shown in Cameron and Trivedi (2010).

¹² The values we get from exponentiation of the original coefficients are 'multiplicative'. For e.g. a factor of 0.75 means a reduction by 25 percent; a factor of 1.25 means an increase of 25 percent.

Table 2.1. Summary statistics of sample, by gender

	Frequency (in %) [Standard deviation]		
Variables	Full sample (N=453,898)	Male (N=199,070)	Female (N=254,828)
Age (in years)	46.03 [16.78]	45.57 [16.53]	46.54 [17.03]
Race/Ethnicity			
American Indian	0.89 [9.40]	0.95 [9.69]	0.83 [9.08]
Pacific Islander	0.25 [4.97]	0.28 [5.29]	0.21 [4.60]
Asian	2.67 [16.13]	2.92 [16.83]	2.41 [15.33]
Black	8.71 [28.20]	7.93 [27.03]	9.56 [29.41]
Hispanic	9.04 [28.68]	9.67 [29.55]	8.36 [27.68]
White	76.46 [42.43]	76.14 [42.62]	76.80 [42.21]
Education level			
Less than high school	8.23 [27.48]	8.94 [28.53]	7.46 [26.27]
Grade 12 or GED	27.29 [44.54]	27.86 [44.83]	26.66 [44.22]
College 1 to 3 years	29.06 [45.41]	27.42 [44.61]	30.86 [46.19]
College 4+ years	35.42 [47.83]	35.78 [47.94]	35.02 [47.70]
Marital status			
Married/unmarried couple	63.33 [48.19]	66.08 [47.34]	60.32 [48.92]
Divorced/separated	11.62 [32.05]	10.16 [30.21]	13.23 [33.88]
Widowed	5.40 [22.60]	2.55 [15.77]	8.51 [27.91]
Never married	19.64 [39.73]	21.21 [40.88]	17.94 [38.36]
Real Household Income			
Less than \$15,000	8.18 [27.40]	6.71 [25.03]	9.78 [29.70]
\$15,000 to \$25,000	14.62 [35.33]	13.45 [34.11]	15.90 [36.57]
\$25,000 to \$35,000	11.52 [31.93]	11.24 [31.59]	11.83 [32.30]
\$35,000 to \$50,000	15.71 [36.39]	15.72 [36.40]	15.70 [36.38]
Greater than \$50,000	49.97 [50.00]	52.88 [49.92]	46.79 [49.90]

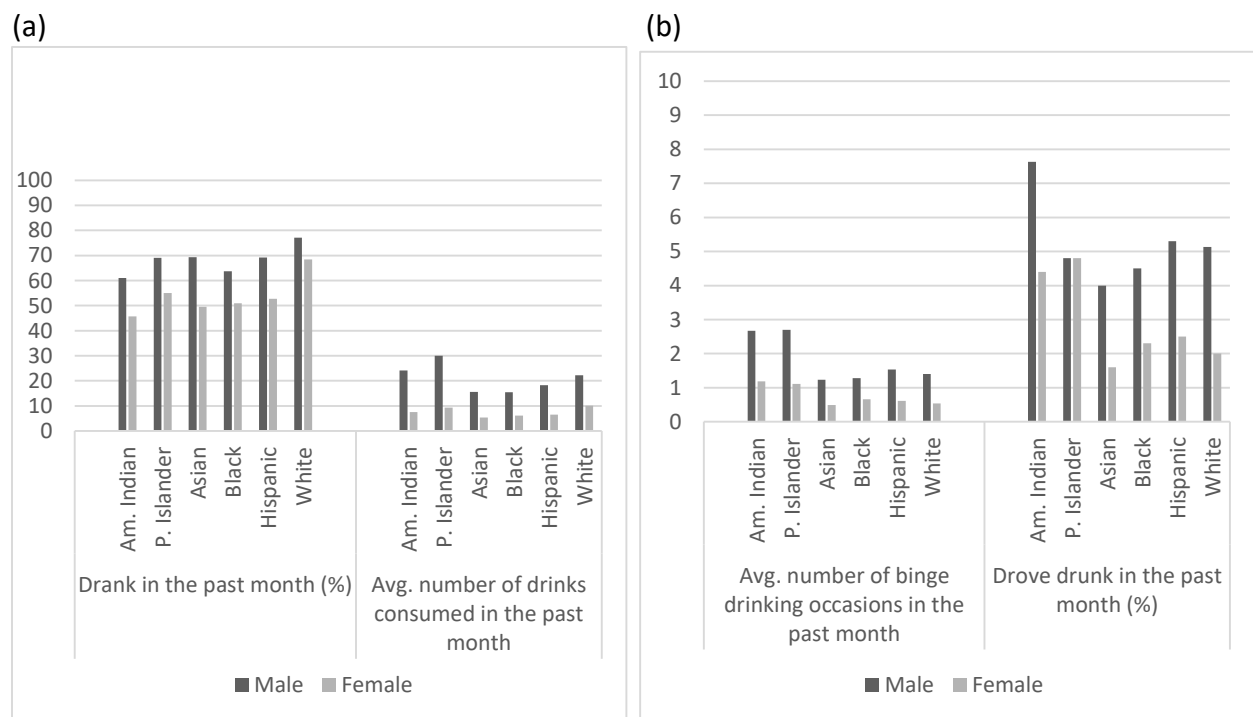
Variables are reported as frequencies (%) unless otherwise stated. Notes: American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

The first bar graph of Figure 2.1(a) shows the percentage of respondents from each race/ethnicity who reported to have drunk at least once in the past month. Among males, White respondents had the highest rates (77.1%), followed by Asian (69.4%), Hispanic/Latinx (69.2%), Native Hawaiian/Pacific Islander (69.1%), Black/African American (63.7%) and American Indian/Alaska Native (61.1%). Likewise, White (68.4%) females were also the ones with the highest percentage of people who drank in the past month, followed by Native Hawaiian/Pacific Islanders (55.1%), Hispanic/Latinx (52.7%), Black/African American (50.9%), Asian (49.5%) and American Indian/Alaska Native (45.7%). The second bar graph shows the average number of drinks consumed by each ethnicity in the past month. Among males, Native Hawaiian/Pacific Islanders consumed the most (30 drinks) followed by American Indian/ Alaska Natives (24.1 drinks), Whites (22.2 drinks), Hispanic/Latinx (18.3 drinks), Asians (15.6 drinks) and Black/African American (15.4 drinks). Among females, Whites consumed the most (10.1 drinks), followed by Native Hawaiian/Pacific Islanders (9.3 drinks), American Indian/ Alaska Natives (7.5 drinks), Hispanic/Latinx (6.5 drinks), Black/African American (6.1 drinks) and Asian (5.4 drinks).

The first bar graph of Figure 2.1(b) shows the average number of binge drinking occasions in the past month by each race/ethnicity. Among males, the highest number of binge drinking was among Native Hawaiian/Pacific Islanders (2.7 times), American Indian/ Alaska Natives (2.67 times), Hispanic/Latinx (1.53 times), Whites (1.4 times), Black/African American (1.28 times) and Asian (1.23 times). Among women, the highest is among American Indian/ Alaska Natives (1.19 times), followed by Native Hawaiian/Pacific Islanders (1.11 times),

Black/African American (0.66 times), Hispanic/Latinx (0.61 times), Whites (0.54 times) and Asian (0.49 times). The second graph shows the percentage of respondents from each race/ethnicity who reported to have drunk driven in the past month. Among males, the highest was for American Indian/Alaska Natives (7.63%), followed by Hispanic/Latinx (5.3%), Whites (5.13%), Native Hawaiian/Pacific Islanders (4.8%), Black/African American (4.5%) and Asian (4%). Among women, the highest was for Native Hawaiian/Pacific Islanders (4.8%), followed by American Indian/Alaska Natives (4.4%), Hispanic/Latinx (2.5%), Black/African American (2.3%), White (2%) and Asian (1.6%).

Figure 2.1. Summary of dependent variables, by race/ethnicity and gender.



Note: The 'drank in the past month' and 'drove drunk in the past month' dependent variables are in terms of percentage (%); while 'average number of drinks consumed in the past month' and 'average number of binge drinking occasions in the past month' dependent variables are in terms of unit values.

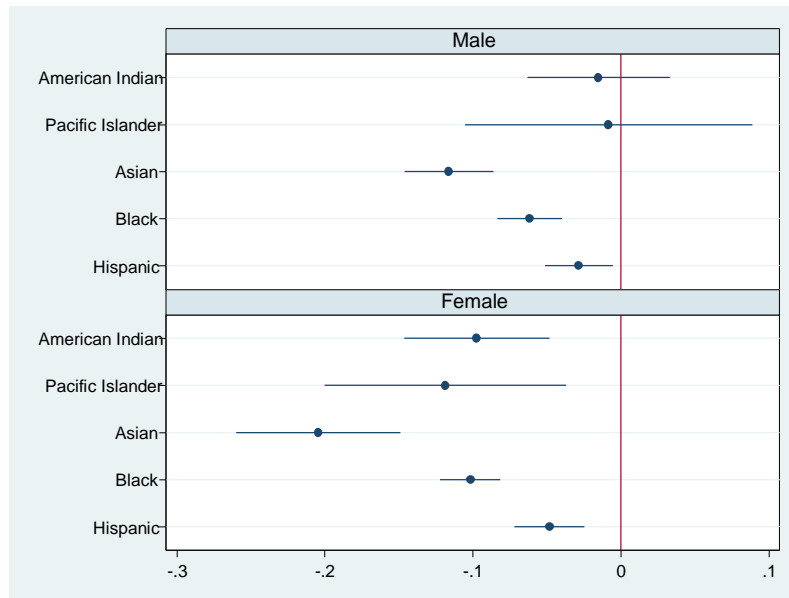
The graphs are separated into two parts in order to account for the large differences in the numeric scales between the dependent variables.

Am. Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; P. Islander=Native Hawaiian/Pacific Islander.

2.4.2 Regression estimates of racial/ethnic group differences

Figures 2.2 to 2.5 depict marginal effects or regression coefficients and 95% confidence intervals, comparing the racial/ethnic indicators from regressions of Equation 1. Figure 2.2 reports the estimated coefficients of the variable 'likelihood the respondent drank in the past month'. The beta coefficient estimates are reported as margins and is separated by gender. The estimates show that certain races/ethnicities were statistically less likely to have drunk in the past month compared to the base group comprising of Whites and other races/ethnicities. Among the male sample, Asians, Blacks/African Americans and Hispanics/Latinx were all less likely to drink in the past month. For women, all five races/ethnicities were less likely to have drunk in the past month. This means that broadly speaking, for most racial/ethnic subgroups and across both genders, respondents were less likely to drink in the past month relative to whites.

Figure 2.2. Comparing whether respondent drank in the past month or not, by race/ethnicity



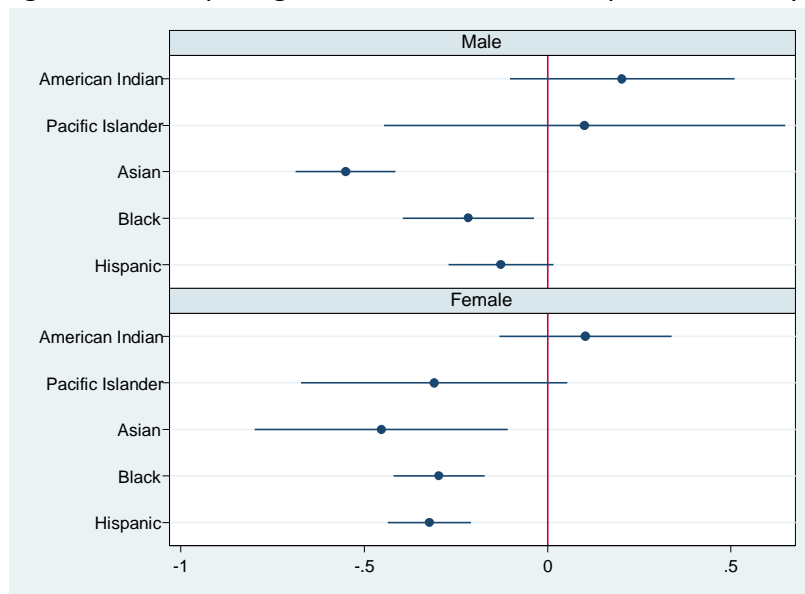
Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Whites). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 1) for each race/ethnicity.

American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

Figure 2.3 reports the estimated coefficients of the variable 'number of drinks in the past month'. This result is derived from the ZINB regression model which models the log of the expected outcome variable as a function of the predictor variable (in this case, it is belonging to one of the five ethnic subgroups). The results show that among the male sample, Asians and Blacks/African Americans drank less (in the past month) compared to the base group. The same was true for the female sample among Asians, Blacks/African Americans and Hispanics/Latinx.

Figure 2.3. Comparing number of drinks in the past month, by race/ethnicity



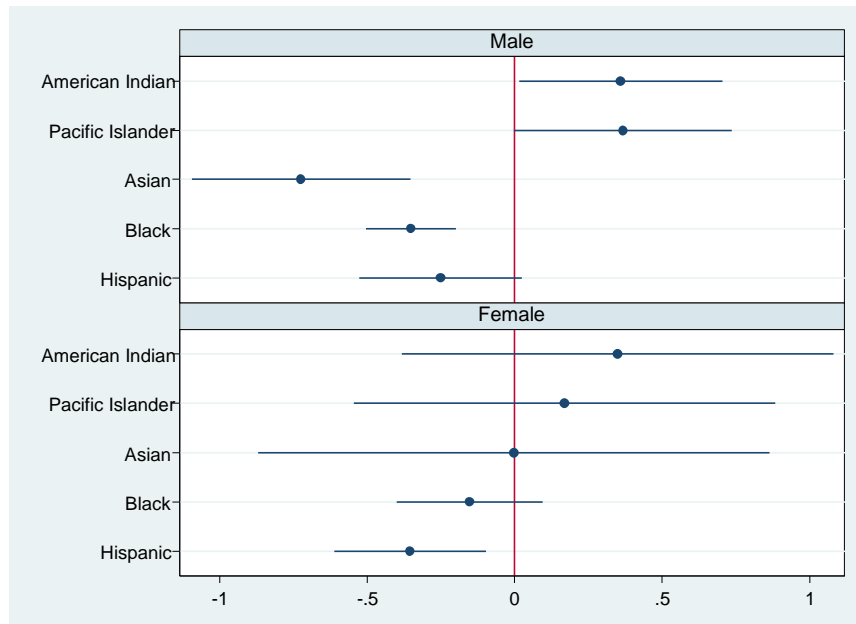
Regression coefficients with 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Whites). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 1) for each race/ethnicity.

American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

Figure 2.4 reports the estimated coefficients of the variable 'binge drinking occasions in the past month'. The estimates come from the negative binomial regression, and like the previous model, the raw coefficients can only be estimated as the log of the expected outcome variable as a function of the predictor variable. The results show that while Asian and Black/African American men had less occasions where they binge drank (in the past month) and American Indians/Alaska Natives binge drank more compared to the base group. Meanwhile, only Hispanic/Latinx women binge drank less than the base group.

Figure 2.4. Comparing binge drinking occasions in the past month, by race/ethnicity



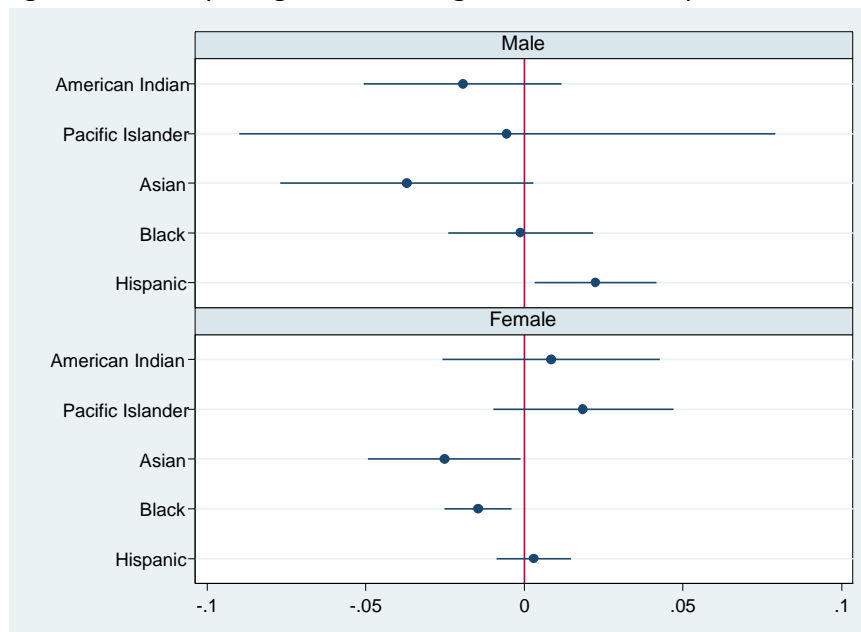
Regression coefficients with 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Whites). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 1) for each race/ethnicity.

American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

Figure 2.5 reports the estimated coefficients of the variable 'likelihood of engaging in drunk driving in the past month'. The estimates are reported as margins after running the probit regression. The results show that the Hispanic/Latinx men were more likely to have driven drunk in the past month compared to the base. For women, both Blacks/African Americans and Asians were less likely to have driven drunk.

Figure 2.5. Comparing drunk driving instances in the past month, by race/ethnicity



Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Whites). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 1) for each race/ethnicity.

American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

2.4.3. The effect of public-place smoking bans on outcomes

Marginal effects of the difference-in-differences (DD) estimator and interactions with racial/ethnic dummy variables are reported in Tables 2.2 and 2.3. After testing, these coefficients were also found to be jointly significant.

The estimates from Table 2.2 show that, as a result of the bans, Black/African American men have reduced both the number of drinks consumed in the past month (by a factor of 0.771) as well as number of binge drinking occasions in the past month (by a factor of 0.808). We also find that Hispanic/Latinx men have reduced their drunk driving instances by 3.1 percentage points compared to white males.

Table 2.2. Effect of public-place smoking bans on drinking outcomes, male

Male	Probability of drinking ^a (Probit)	No. of drinks ^b (ZINB)	Binge drinking ^b (Neg. Binomial)	Drunk driving ^a (Probit)
DD	-0.002 [0.005]	0.987 [0.032]	1.001 [0.055]	-0.011 [0.006]
DD*American Indian	-0.039 [0.035]	0.959 [0.186]	0.900 [0.196]	0.030 [0.029]
DD*Pacific Islanders	-0.092 [0.057]	0.778 [0.266]	0.620 [0.199]	0.007 [0.066]
DD*Asian	0.002 [0.023]	0.963 [0.080]	1.060 [0.158]	0.015 [0.034]
DD*Black	-0.001 [0.011]	0.771** [0.091]	0.808** [0.086]	-0.019 [0.017]
DD*Hispanic	0.005 [0.015]	0.868 [0.071]	0.930 [0.124]	-0.031*** [0.008]
No. of Observations	199,070	199,070	150,375	67,907

^a Estimates reported as margins; ^b Estimates reported as factors

Note: The 'DD' estimates are equal to the β_2 coefficients, while the 'DD*race/ethnicity' estimates are equal to the β_3 coefficients from equation 1. These coefficients are jointly significant.

Here, factors refer to being 'multiplied' by. For e.g. the table shows that Black men saw their number of drinks consumed in the past month change by a multiplicative of 0.771, which means they experienced a 22.9 percent reduction. Margins are more directly interpretable as percentage point change.

***1% significance level; **5% significance level. Cluster robust standard errors are reported in parentheses

Notes: American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

The estimates from Table 2.3 show that the number of drinks consumed by women, on average, increased by a factor of 1.089 as a result of the ban. Hispanic/Latinx women were 3.2

Table 2.3. Effect of public-place smoking bans on drinking outcomes, female

Female	Probability of drinking ^a (Probit)	No. of drinks ^b (ZINB)	Binge drinking ^b (Neg. Binomial)	Drunk driving ^a (Probit)
DD	-0.002 [0.012]	1.089*** [0.027]	1.147 [0.085]	-0.008 [0.004]
DD*American Indian	0.002 [0.034]	1.070 [0.284]	3.023 [2.263]	0.025 [0.022]
DD*Pacific Islanders	0.010 [0.060]	0.894 [0.183]	0.628 [0.250]	-0.039 [0.022]
DD*Asian	-0.008 [0.027]	0.987 [0.183]	0.462 [0.199]	0.008 [0.017]
DD*Black	0.025*** [0.009]	0.926 [0.081]	0.721** [0.104]	0.014 [0.008]
DD*Hispanic	-0.032*** [0.010]	1.064 [0.065]	0.818 [0.114]	-0.008 [0.008]
Number of Observations	254,828	254,828	167,532	74,397

^a Estimates reported as margins; ^b Estimates reported as factors

Note: The 'DD' estimates are equal to the β_2 coefficients, while the 'DD*race/ethnicity' estimates are equal to the β_3 coefficients from equation 1.

Here, factors refer to being 'multiplied' by. For e.g. the table shows that Black women saw their number of binge drinking occasions in the past month change by a multiplicative of 0.721, which means they experienced a 27.9 percent reduction. Margins are more directly interpretable as percentage point change.

***1% significance level; **5% significance level. Cluster robust standard errors are reported in parentheses

Notes: American Indian=American Indian/Alaska Native; Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

percentage points less likely to have drunk in the past month, while Black/African American women were 2.5 percentage points more likely to have done the same. On the other hand, Black/African American women experienced a reduction in the number of binge drinking

occasions by a factor of 0.721 as a result of the bans. Women did not experience a change in drunk driving instances.

These results are robust to different iterations and specifications of the model. It is also robust to placebo regressions (using 'whether or not respondents received a flu-shot as a variable).

2.5. Discussion

Our results show that some ethnic/racial minorities are more responsive to the public place smoking bans than others. We find that Blacks/African Americans and Hispanics/Latinx were especially receptive to the bans. This may be attributable to ethnic enclaves, which we discussed in the literature review section. An ethnic enclave can affect drinking behavior either positively or negatively. For instance, evidence shows that collective efficacy (i.e. the ability to convert social bonds to actions that create a safe and orderly environment) can affect how well neighborhoods are able to control negative behaviors- such as drinking (Sampson et al., 1997). Thus, if a particular community or ethnic enclave has better collective efficacy, it might translate into better drinking outcomes (Fagan et al., 2014).

On the other hand, relaxed community norms about the culture of drinking and tolerance for drunkenness can lead to more binge drinking (Ahern et al., 2008). A 2010 report by the U.S. National Highway Traffic Safety Administration points out that the risk of traffic accidents resulting from alcohol consumption and impaired driving are higher for Hispanic drivers compared to White or Black/Africa American drivers (National Highway Traffic Safety Administration (NHTSA), 2010). It also mentions that one of the reasons for this is because the Hispanic community are less likely to consider DUIs a problem. This finding supports one of the

puzzling results in this paper. In Figure 2.5, we found that Hispanic/Latinx men were more likely to have driven drunk in the past month. The National Highway Traffic Safety Administration's finding could be a possible explanation. This result does not conflict with what we find in Table 2.2, which shows Hispanic men reduced drunk driving instances as a result of the ban. This can be interpreted as the ban causing a slowdown in drunk driving over the period (i.e. Hispanic/Latinx men may have engaged in relatively more drunk driving than they did if not for the bans).

Another perplexing result is that women seem to be drinking more as a result of the bans, especially Hispanic/Latinx women. While this has not been previously studied, one plausible reason may be that women find it more comfortable to visit bars and stay for longer periods as a result of the bans¹³. Another hypothesis is that concurrent smokers and drinkers may choose to stay home and drink rather than go to bars. As a consequence, women in the household may join them and thus drink more frequently. However, evidence from Ireland suggests that this may not be the case as they found that neither smoking nor drinking increased in the household as a result of smoking bans (Hyland et al., 2007). Further research needs to be conducted to understand the U.S context.

2.6. Limitations

A limitation of this study is that respondents were only identifiable at the state level. In some instances, public-place smoking bans had already been implemented in certain jurisdictions. As a result, our findings are likely understating the effect of the bans. The results

¹³ Anecdotal reports provide some support for the hypothesis (Claire Churchard & Townshend, 2017; Tweedie, 2007)

may also be understated because respondents living in Native American reservations are not always subject to the state-level bans. We do not observe whether Native American/Alaska Native respondents live on a reservation.

Other limitations include having to use tax on beer as a proxy for alcoholic beverage prices. Even though using price data as a determinant of alcohol demand would be the best, there are several issues that prevent me from doing so. For instance, a common data source for alcohol prices often used in past research is the Cost of Living Index published by the American Chamber of Commerce Research Association. However, this data suffers from issues of measurement errors and the fact that data is collected for only a representative brand of alcoholic beverage which may not reflect the purchases of the typical drinker (Young & Bielinska-Kwapisz, 2003). As a result, many researchers choose to use taxes on alcoholic beverages to proxy price variation instead. However, an issue arises when trying to determine taxes on distilled spirits and wines in states that control the sale of spirits and wine at the wholesale level. Some studies use Uniform Product Code data (Ruhm et al., 2012), which collects barcode data for products sold at stores, including alcohol sales. However, this data is proprietary and is not collected for all states (including some of the states included in our study). Another limitation is being unable to more capture attitudes towards risky health behavior.

CHAPTER 3

THE EFFECT OF PUBLIC-PLACE SMOKING BANS ON SMOKING BEHAVIOR AMONG PREGNANT WOMEN OF DIFFERENT RACES AND ETHNICITIES IN THE UNITED STATES

3.1. Introduction

Many countries around the world, including the United States, have implemented public-place smoking bans with the aim of reducing smoking and exposure to second-hand smoke. Given that smoking is a leading cause of preventable deaths occurring from cancer, cardiovascular diseases, respiratory illness, etc. in the United States (CDC, 2019), the government and public-health experts have been adamant about implementing smoking cessation policies in recent decades. Public-place smoking bans are one such method.

When it comes to smoking and exposure to second-hand smoke, pregnant women are a vulnerable group. Smoking during pregnancy not only negatively affects the mother's health, but also puts the child's health at risk. This health risk is often exacerbated by the socioeconomic status of women, such as low educational attainment (Gilman et al., 2008; Smedberg et al., 2014). Since racial/ethnic minorities tend to bear a disproportionate burden of smoking-related morbidity and mortality (American Psychological Association, 2013; King et al., 1997) and have lower socio-economic status (Reeves et al., 2016; Williams et al., 2010), it is important to assess whether large-scale smoking cessation policies, such as public-place smoking bans, have the intended effect, and whether the effects are different for pregnant women from racial/ethnic minorities. Thus, we estimate the effect of public-place smoking bans on the smoking behavior of pregnant women, testing for heterogeneity across racial/ethnic groups, thereby contributing to the gap in literature.

3.2. Literature Review

3.2.1. Predictors of prenatal smoking

According to a 2014 report published by the Centers for Disease Control and Prevention (CDC), about 1 in 10 women who gave birth in 2014 in the United States smoked during the first 3 months of their pregnancy, and 8.4% smoked during any of the three trimesters (Curtin & Matthews, 2016). Recent studies have looked at socio-economic factors that influence tobacco use during pregnancy. For instance, low socio-economic status, lack of social support and poor mental health (such as depression) are predictors of prenatal smoking (Al-Sahab et al., 2010; Heaman & Chalmers, 2005; Lasser et al., 2000). Even though prenatal smoking has been declining in the United States since the 1960s, the lowest rate of decline has been among women with a high school education (32% in 1974 versus 27% in 2000), while it declined from 26% to 10% during the same period among women with a bachelor's degree or higher (Cnattingius, 2004).

Another important predictor of prenatal smoking is race/ethnicity of the mother. In the United States, there are substantial racial/ethnic disparities: American Indian/Alaska Natives have the highest rate (19.6%), followed by Whites (10.8%), Black/African Americans (9.7%), Hispanic/Latinx (2%) and Asian/Pacific Islanders¹⁴ (1.6%) (National Center for Health Statistics, 2012; Washio & Cassey, 2016)¹⁵. Moreover, there are disparities within particular racial/ethnic

¹⁴ Historically, the U.S. Census merged individuals who identified as Asian and Native Hawaiian/Pacific Islanders. More recently this practice has changed and in this paper, Asians and Native Hawaiian/Pacific Islanders are reported separately.

¹⁵ There is also evidence of racial/ethnic disparities in the Canadian context. For example, Heaman and Chalmers (2005) found that a significantly higher proportion of Indigenous women (61.2%) smoked during pregnancy

groups. For instance, among Hispanic/Latinx in 2011, the prenatal smoking rate was 12.2% for Puerto Ricans, 7.1% for Cubans and 1.4% for Mexicans (Washio & Cassey, 2016).

3.2.2. Effects of prenatal smoking

There is evidence that smoking during pregnancy is one of the leading causes of preterm births, low birth weight, stillbirths, ectopic pregnancy, placental abruption and sudden infant death syndrome (Agrawal et al., 2010; Heaman & Chalmers, 2005; Markowitz et al., 2013; United States Department of Health & Human Services (USDHHS), 2014). Combined with an increased risk of respiratory infections and reduced cardiovascular function, these complications contribute to higher rates of perinatal and neonatal mortality in infants whose mothers smoked during pregnancy (Lumley et al., 2004; United States Department of Health & Human Services (USDHHS), 2014). Moreover, for those who survive, the effects of prenatal smoking can persist into adulthood, with studies showing that affected children have higher prevalence of behavioral problems (e.g. Attention Deficit Hyperactivity Disorder), coronary artery disease, diabetes, asthma and other complications resulting from being overweight (Agrawal et al., 2010; Almond & Currie, 2011; Braun et al., 2009; Cnattingius, 2004; Lumley et al., 2004; Oken et al., 2008).

Perhaps and unsurprisingly, children who are exposed to smoking during pregnancy are also more likely to have challenges related to human capital development. Studies in this area show that such children, on average, have worse education and labor market prospects, lower IQ scores and earn less in their adult life (Almond & Currie, 2011; Braun et al., 2009; Lambe et

compared to 26.2% of non-Indigenous women in Manitoba, Canada. Another study found that prenatal smoking is especially prevalent in the northern territories, which have large Indigenous populations (Al-Sahab et al., 2010).

al., 2006; Markowitz et al., 2013). For instance, in a study evaluating the relationship between maternal smoking and children's performance on memory, learning and problem solving at age 10, Cornelius et al. (2001) found a significant negative association, while Lambe et al. (2006) found poorer scholastic achievements (Lambe et al., 2006). However, researchers also point out that other factors (such as parent's IQ) may be confounding these results (Braun et al., 2009).

In addition to mortality, morbidity and lower human capital development, maternal smoking imposes substantial economic costs on the children, their families and to society more broadly. For example, the smoking-attributable healthcare cost in the U.S. was estimated to be \$170 billion in 2010 (Xu et al., 2015). Moreover, smoking-related expenses for neonates were \$122 million in 2004 dollars (E. K. Adams et al., 2011). Another study estimated the additional costs attributable to smoking for both mother and child in the first year to be between \$1142 and \$1358 per prenatal smoker (Miller et al., 2001). Of course, the actual costs over a child's lifetime are expected to be much higher, especially if the child suffers from chronic diseases associated with prenatal smoking. In addition, there are other costs for the family as well as to the society. For instance, prenatal smoking can lead to a loss in productivity if a parent has to cut back or leave work to take care of the affected child; it can be a drain on the health care system; and there may be reduced well-being of both the affected child and their family (Miller et al., 2001; Xu et al., 2015).

3.2.3. Smoking cessation policies

Given the high economic and social costs of smoking, governments around the world have enacted more progressive tobacco control policies over the decades. There exists an extensive literature on the effect of such policies in the United States and other developed nations. These studies have explored the effect of taxation (Adda & Cornaglia, 2010; Chaloupka & Grossman, 1996; Nonnemaker & Farrelly, 2011), public-place smoking bans (Anger et al., 2011; Carpenter et al., 2011; Jones et al., 2015; Owyang & Vermann, 2012; Tauras et al., 2013) and access restrictions (Chaloupka & Grossman, 1996). Most studies have found that smoking bans have little effect on smoking behavior, but reduces exposure to second-hand smoking in public places, without significant displacement (i.e. from public places to private) (Adda & Cornaglia, 2010; Carpenter et al., 2011; Owyang & Vermann, 2012). Comparatively, Adda and Cornaglia (2010) find that taxation is better than public-place bans in reducing exposure to secondhand smoke. Similarly, Chaloupka et al. (1996) find that taxation is likely to reduce youth smoking compared to public-place smoking bans and access restrictions.

In terms of birth outcome, Been et al. (2015) estimate the effect of the 2007 smoke-free legislation in England on indicators of early-life mortality (i.e. stillbirths, low birth weight, neonatal mortality and sudden infant death syndrome). The results showed a 7.8% reduction in odds of being stillborn, a 3.9% reduction in the odds of low birth weight and a 7.6% reduction in the neo-mortality rate. Similarly, Adams et al. (2012) find that higher cigarette taxes, higher prices and workplace smoking bans are associated with an increased probability of quitting by the third trimester, especially among young mothers. Nevertheless, there is a dearth in research on the effect of smoking cessation policies on racial/ethnic minority pregnant women

(Washio & Cassey, 2016). These differences are important to consider because of disparities in prenatal smoking rates. For instance, the proportion of infant deaths due to low birth weight attributable to prenatal smoking is significantly higher among American Indian/Alaska Native women (England et al., 2012; Salihu et al., 2003). Prenatal smoking is also associated with persistent asthma among children who are Mexican, Puerto Rican and Black/African American (Akuete et al., 2011).

In addition to the racial/ethnic disparities in prenatal smoking and related outcomes, studies point to barriers that preclude pregnant women from racial/ethnic minority groups from participating in tobacco cessation programs or gaining access to such resources (Glasgow et al., 2000; King et al., 1997). These barriers include: inaccessible healthcare; lack of insurance; lack of transportation; lack of childcare; language barriers; immigration status; level of acculturation; and cultural beliefs (English et al., 2010; Koh et al., 2010). These factors, combined with the fact that racial/ethnic minority women tend to have lower socio-economic status (SES)¹⁶ (Heaman & Chalmers, 2005; Williams et al., 2010), mean that women in some racial/ethnic minority groups (such as American Indian/Alaska Natives) may have an increased rate of smoking during pregnancy, as well as more limited access to smoking cessation programs and pre/post-natal care¹⁷ (American Psychological Association, 2013; King et al., 1997).

¹⁶ As noted earlier, lower SES is a determinant of prenatal smoking.

¹⁷ Studies have found that smokers of lower SES are just as likely to attempt quitting as those of higher SES, however they are less likely to be successful due to the barriers discussed (Fitzgerald, 2012; Kotz & West, 2008).

3.2.4. Theoretical framework for smoking behavior

Apart from external policy pressures (such as taxation and bans on smoking), the household's views on smoking can play an important role in the controlling of such risky health behavior. This is complicated by the fact that household norms and dynamics may vary significantly by race/ethnicity.

For instance, research on the spousal influence on smoking behaviors have shown that having a partner who smokes can influence the spouse's initiation of smoking, to return to smoking after having quit or increase the frequency of smoking (Homish & Leonard, 2005). Past studies have looked at Hispanic/Latino smoking risks due to parental and peer influence (Livaudais et al., 2007; McCleary-Sills et al., 2010). They find a positive link between spousal smoking and women's decision to initiate smoking or return to smoking after having quit, as well as a reduced probability of quitting (Cobb et al., 2014; Homish & Leonard, 2005).

Acculturation to the U.S. can also be a significant factor in people (especially women) in the household to either take up smoking or increase the frequency. Thus, as people become more used to the social norms of the U.S., they may begin to view smoking as less of a taboo. Studies on Hispanic/Latinx women (compared to men) have shown that they are more likely to take up smoking with American acculturation, which reduces family cohesion and relaxes negative attitudes toward smoking that are usually more rigid in traditional Hispanic families (Flores et al., 2018; Lorenzo-Blanco & Cortina, 2013). Thus, our hypothesis is that respondents belonging to certain races/ethnicities are more susceptible to smoking, and this condition can be exacerbated if the policy displaces smoking to homes.

3.3. Methods

3.3.1. Data

This paper uses repeated cross-sectional data from the Behavioral Risk Factor Surveillance System (BRFSS), ranging from 2002 to 2012. The BRFSS is a nationally representative annual survey of adults in the United States collected by the CDC. The BRFSS data consists of individuals aged 18 and older, covering all 50 states and the District of Columbia (DC). Those living on Native American reserves and military bases are included in the survey.

From 2002 to 2010, data were collected using a disproportionate stratified sampling design. Here, the BRFSS divided landline telephone numbers into three strata: high, medium and low density strata. The high-density and medium-density strata consisted of telephone numbers that were expected to contain a large proportion of households. The low-density stratum consisted of telephone numbers that were expected to contain a small proportion of households (BRFSS, 2002). The high-density and medium-density strata were sampled at a higher rate than the low-density stratum to obtain a sample that contains a larger proportion of households than would be the case if all were sampled at the same rate. These samples are weighted so that each response counts the same way as any other response. The final weight assigned to each respondent is defined by: (1) the design weight, which incorporates the probability of falling into each of the three strata, and adjusts for non-response and noncoverage bias; and (2) a demographic adjustment of the population, where the number of people is sampled to a known proportion of age, ethnicity, sex and geographic region for each state (post stratification). The sampling design changes slightly from 2011 onward as the BRFSS incorporated cell phone surveys in addition to landlines. Another change was in the weighting

method to adjust to possibility of a household having more than one phone¹⁸ (BRFSS, 2011). It also allowed for the introduction of additional demographic variables in the post-stratification demographic adjustment process, such as education level, marital status and home-ownership.

Our sample consists of 8,210 pregnant women who self-reported being pregnant at the time of interview¹⁹ (2002 to 2012) and were either current or former smokers. As part of the data cleaning process, we dropped observation that were missing data on key variables. We dropped respondents who identified as American Indian/Native Alaskan because public-place bans do not extend to all federally-recognized Native American reservations, which have sovereign status and are exempt from tobacco-control laws.

The data on smoking bans come from the American Nonsmokers' Rights Foundation (ANSRF), an organization that maintains records of states and municipalities with laws to limit smoking in workplaces, restaurants and bars (ANSRF, 2018). Records include the timing and extent of such bans²⁰. In 2002, Delaware became the first state to have a 100% public-place ban. By 2014, public-place bans covered 36 states (including DC) and affected around 81.8% of the U.S. population (ANSRF, 2018). We do not consider states with less than 100% bans in workplaces, restaurants, bars and gambling facilities. Moreover, we do not consider bans at

¹⁸ The new sample frame required an adjustment to address the respondent's probability of selection in both the landline and cell phone sample frames.

¹⁹ It is important to note that pregnant women themselves were the respondents in the BRFSS survey. The BRFSS does not conduct interviews via proxy.

lower spatial because the publicly available BRFSS survey does not provide geographical information below the state level.

3.3.2. Econometric model

Similar to the identification strategy used by Carpenter et al. (2011) and Adda & Cornaglia (2010), we identify the effect of public-place smoking bans on the smoking behavior of pregnant women using a difference-in-differences approach by exploiting variation in the timing of the bans across states. Our estimating equation is:

$$Prob(Y_{ist} = 1|X) = \phi(\beta_0 + \beta_1 \sum_{j=1}^4 RaceEthnicity_i + \beta_2 Ban_{st} + \beta_3 \sum_{j=1}^4 (Ban_{st} * RaceEthnicity_i) + \beta_4 \mathbf{K}_{ist} + \beta_5 \mathbf{Z}_{st} + \mathbf{State}_s + \mathbf{Year}_t) \quad (2)$$

For an individual i in state s and time period t , Y_{ist} represents one of the following five binary outcomes: (1) current versus former smoker; (2) daily versus occasional smoker; (3) occasional versus former smoker; (4) daily versus former smoker; and (5) attempted to quit smoking in the past year. $RaceEthnicity_i$ indicates whether the individual self-identified as White, Black/African American, Asian or Hispanic/Latinx. The base group is women who identified as Native Hawaiian/Pacific Islander, ‘mixed’ or ‘other’ race/ethnicity. Ban_{st} captures whether the individual was affected by a ban. β_2 is the difference-in-differences (DD) estimator indicating the average effect of the bans. β_3 reflects differences in the effect of the public-place smoking bans across races/ethnicities relative to the base, and is interpreted as a change in the probability of the outcome being equal to one. \mathbf{K}_{ist} contains individual characteristics, including age, marital status and real income. \mathbf{Z}_{st} contains time-varying state characteristics, such as

unemployment rates, attitudes toward smoking and real cigarette prices. *State_s* and *Year_t* are state and time fixed effects.

Equation 2 is estimated by level of educational attainment (low versus high) using probit regressions and the resulting average marginal effects are reported. ‘Low educational attainment’ refers to individuals with a high school education or lower. ‘High educational attainment’ refers to at least some level of college education. We choose educational attainment level as literature frequently cites this factor as a crucial determinant of smoking during pregnancy (Gilman et al., 2008; Kandel et al., 2009; Smedberg et al., 2014). Normalized sampling weights are applied in all regressions and robust errors are clustered at the state level.

3.4. Results

3.4.1. Descriptive statistics

The socio-demographic characteristics of our sample are shown in Table 3.1. The majority of the sample consists of women who identified themselves as White (75.1%), followed by Hispanic/Latinx (12.3%), Black/African American (7.9%) and Asian (1.6%). Pacific Islanders and ‘other’ races/ethnicities make up the rest of the sample (base group).

There is some racial/ethnic variation when it comes to level of educational attainment. In the sample, respondents are more likely to have a higher level of education than otherwise if they are White or Asian (making up 80.1% and 2.2% of the ‘high educational attainment’ sample, respectively). On the other hand, Black/African American and Hispanic/Latinx women

Table 3.1. Descriptive statistics of sample, by educational attainment

	Frequency (%)		
Variables	Full sample (N=8,210)	Low educational attainment (N=3,218)	High educational attainment (N=4,992)
Age (in years)	27.86 [5.94]	25.55 [5.85]	29.68 [5.34]
Race/ethnicity			
White	75.09 [43.25]	68.68 [46.39]	80.12 [39.91]
Black	7.89 [26.96]	11.34 [31.71]	5.19 [22.18]
Asian	1.61 [12.57]	0.83 [9.07]	2.21 [14.72]
Hispanic	12.29 [32.84]	15.37 [36.07]	9.88 [29.84]
Pacific Islander	0.30 [0.54]	0.30 [0.54]	0.28 [0.53]
Marital status			
Married/unmarried couple	70.11 [45.78]	56.70 [49.56]	80.64 [39.52]
Divorced/separated	7.99 [27.12]	10.56 [30.74]	5.97 [23.70]
Never married	21.90 [41.36]	32.74 [46.93]	13.39 [34.05]
Real Household Income			
Less than \$15,000	13.95 [34.65]	23.46 [42.38]	6.49 [24.64]
\$15,000 to \$25,000	22.30 [41.63]	34.97 [47.69]	12.35 [32.91]
\$25,000 to \$35,000	11.60 [32.03]	13.34 [34.01]	10.23 [30.31]
\$35,000 to \$50,000	15.27 [35.97]	14.12 [34.83]	16.17 [36.82]
Greater than \$50,000	36.88 [48.25]	14.11 [34.82]	54.75 [49.78]

Variables are reported as frequencies (%) unless otherwise stated. Robust standard deviations are shown in parentheses.

Note: Low educational attainment refers to having a high school level education or less. High educational attainment refers to at least some college education and more.

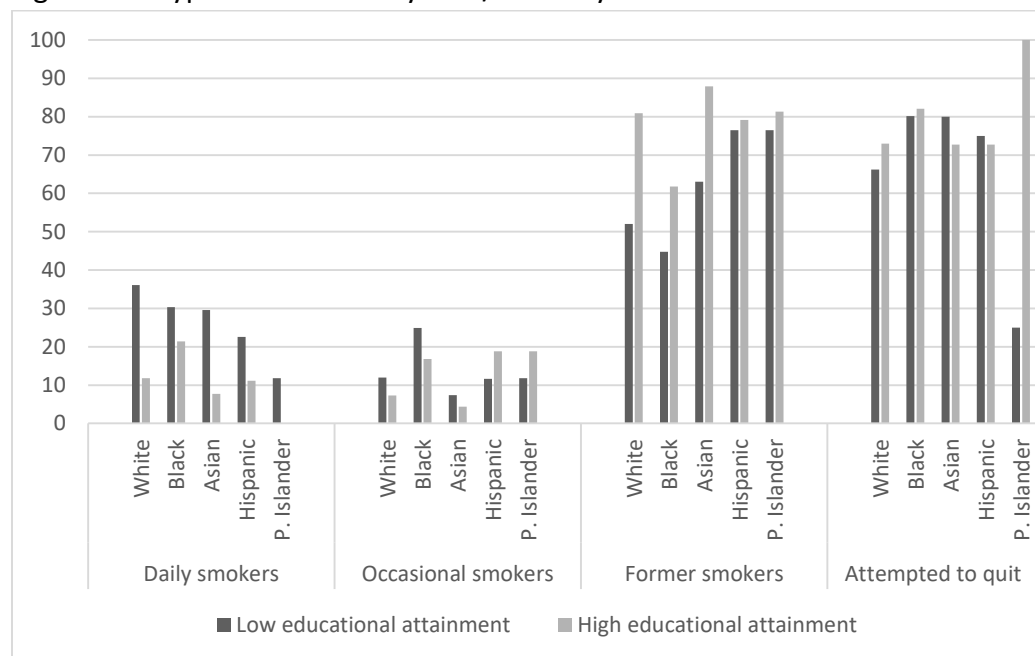
Black=Black/African American; Hispanic=Hispanic/Latinx; Pacific Islander=Native Hawaiian/Pacific Islander.

are more likely to have a lower level of education than otherwise (15.4% and 11.3% of the 'low educational sample', respectively). Moreover, women with low educational attainment are more likely to be divorced/separated or never married (10.6% and 32.7%, respectively) compared to their high education counterparts (6% and 13.4%, respectively).

Perhaps not surprisingly, women with a lower level of educational attainment have lowest levels of household income compared to women in the high education group (23.5% and 6.5% have household income below \$15,000, respectively). Likewise, a large portion of the high education group have household incomes greater than \$50,000 (54.8%), compared to only 14.1% of their low education counterpart.

Figure 3.1 shows the proportion of women who are daily, occasional and former smokers, as well as those who attempted to quit. This is further subdivided by race/ethnicity and the level of educational attainment. In general, women with a low educational attainment are more likely to smoke during pregnancy, both daily and occasionally (except Hispanic/Latinx women who are occasional smokers). An interesting result is that, when it comes to former smokers, the high education group seems to be able to quit more successfully compared to the low education group. This is perhaps anecdotal evidence of the financial and/or social barriers faced by women in the low education group. There is little difference in the rates of women attempting to quit smoking across racial/ethnic groups.

Figure 3.1. Types of smokers by race/ethnicity and education



Note: Low educational attainment refers to having a high school level education or less. High educational attainment refers to at least some college education and more. The units are in percent.

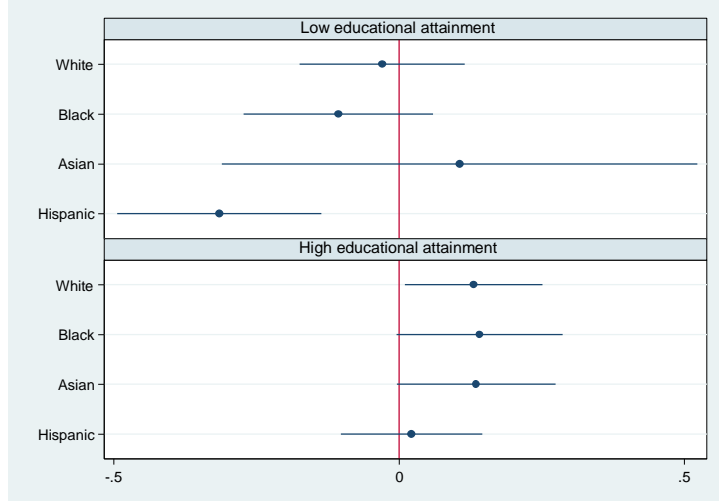
Black=Black/African American; Hispanic=Hispanic/Latinx; P. Islander= Native Hawaiian/Pacific Islander.

3.4.2. Regression estimates of racial/ethnic group differences

Figures 3.2 to 3.6 depict average marginal effects²⁰ and 95% confidence intervals of racial/ethnic indicators from the probit regressions of Equation 1. In Figure 3.2, we find that Hispanic/Latinx women with low educational attainment were less likely to be currently smoking (more likely to be former smokers) during pregnancy, compared to the base group. On the other hand, White women from the high educational attainment group were more likely to be smokers compared to the base group.

²⁰ For numeric values, refer to Tables A.1. and A.2.

Figure 3.2. Comparing current versus former smokers, by race/ethnicity



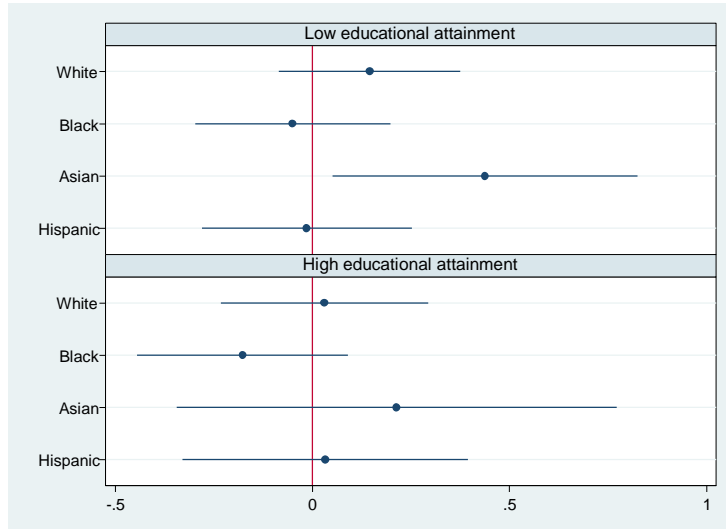
Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Native Hawaiian/Pacific Islander). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 2) for each race/ethnicity.

Black=Black/African American; Hispanic=Hispanic/Latinx.

Figure 3.3 depicts that Asian women of low educational attainment were more likely to be daily smokers (versus occasional smokers) compared to the base. Figure 3.4 and 3.5 show that, relative to base group, Hispanic/Latinx women with low educational attainment were less likely to be occasional and daily smokers, respectively (more likely to be former smokers). Finally, Figure 3.6 indicates that White women with low educational attainment were less likely to attempt to quit smoking in the past year compared to the base.

Figure 3.3. Comparing daily versus occasional smokers, by race/ethnicity

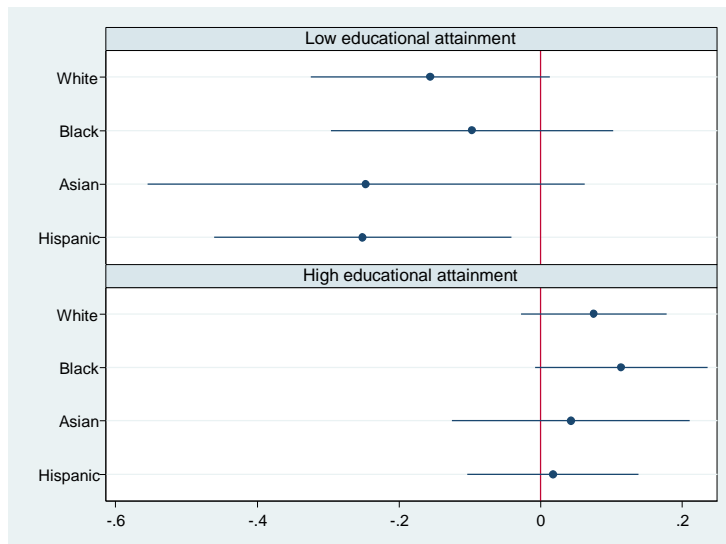


Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Native Hawaiian/Pacific Islander). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 2) for each race/ethnicity.

Black=Black/African American; Hispanic=Hispanic/Latinx.

Figure 3.4. Comparing occasional versus former smokers, by race/ethnicity

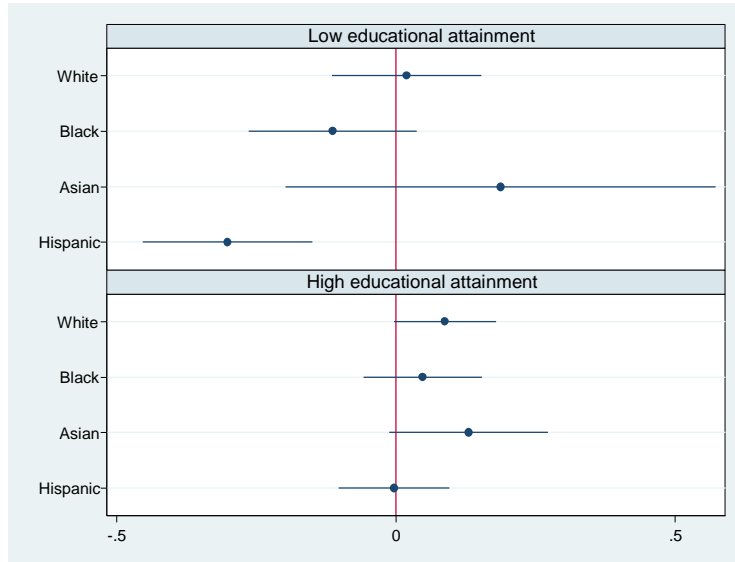


Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Native Hawaiian/Pacific Islander). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 2) for each race/ethnicity.

Black=Black/African American; Hispanic=Hispanic/Latinx.

Figure 3.5. Comparing daily versus former smokers, by race/ethnicity

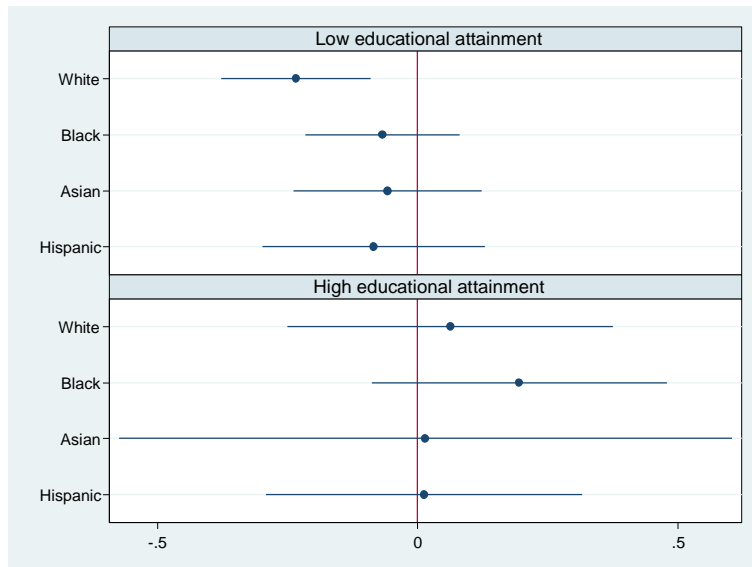


Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Native Hawaiian/Pacific Islander). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 2) for each race/ethnicity.

Black=Black/African American; Hispanic=Hispanic/Latinx.

Figure 3.6. Comparing attempted to quit or not, by race/ethnicity



Marginal effects and 95 percent confidence interval bars

Notes: In the figure, '0' represents whether the results are significantly different from the base group (i.e. Native Hawaiian/Pacific Islander). The values show the effect on each ethnicity, regardless of the ban, and is equal to the coefficients of $\beta_1 - \beta_0$ (equation 2) for each race/ethnicity.

Black=Black/African American; Hispanic=Hispanic/Latinx.

3.4.3. Effects of public place smoking-bans on different ethnicities

Tables 3.2 and 3.3 contain average marginal effects of the difference-in-differences (DD) estimator and interactions with racial/ethnic indicators from probit regressions of Equation 1. Consistent with past literature, public-place smoking bans do not affect smoking behavior as a whole. However, there are interesting effects when disaggregating by race/ethnicity. First, looking at the low educational attainment group (Table 3.2), public-place bans increase the probability of being a daily smoker by 33.9 percentage points among Hispanic/Latinx women; they are smoking more frequently. What this means is that as a result of the ban, Hispanic/Latinx pregnant women are smoking more frequently than the base group. This is a surprising result, however, it is robust to different iterations and specifications of the model. It is also robust to placebo regressions (using 'whether or not respondents received a flu-shot' as a placebo variable). The results are also jointly significant.

Table 3.2. Effect of public-place smoking bans on smoking outcomes, low educational attainment.

	Low educational attainment				
	Current versus Former	Daily versus Occasional	Occasional versus Former	Daily versus Former	Attempted to quit
DD	0.025 [0.129]	-0.181 [0.164]	0.096 [0.134]	-0.084 [0.143]	0.159 [0.150]
DD*White	0.044 [0.134]	0.085 [0.149]	0.008 [0.123]	0.121 [0.139]	0.012 [0.149]
DD*Black	-0.014 [0.145]	0.181 [0.177]	-0.080 [0.135]	0.096 [0.143]	0.170 [0.162]
DD*Asian	-0.329 [0.299]	0.027 [0.290]	-0.177 [0.244]	-0.194 [0.285]	-
DD*Hispanic	0.132 [0.169]	0.339** [0.142]	-0.085 [0.138]	0.280 [0.153]	-0.259 [0.178]
No. of observations	3,218	1,512	2,112	2,778	1,504

***1% significance level; **5% significance level. Clustered robust standard errors are reported in parentheses

Notes: Current refers to both daily and occasional smokers combined. The 'DD' estimates are equal to the β_2 coefficients, while the 'DD*race/ethnicity' estimates are equal to the β_3 coefficients from equation 2. These coefficients are jointly significant. The blank results are due to there not being enough observations for a particular subset of our sample.

Black=Black/African American; Hispanic=Hispanic/Latinx.

Next, looking at the high educational attainment group (Table 3.3), Black/African American women were 14.0 percentage points less likely to be occasional smokers (more likely to be former smokers) as a result of the public-place bans. Moreover, Asian women were less likely to be current smokers (by 40.3 percentage points) and daily smokers (by 28.5 percentage points) versus former smokers. This implies that Asian women quit smoking during pregnancy as a result of the bans.

Table 3.3. Effect of public-place smoking bans on smoking outcomes, high educational attainment.

	High educational attainment				
	Current versus Former	Daily versus Occasional	Occasional versus Former	Daily versus Former	Attempted to quit
DD	0.161 [0.084]	0.377 [0.248]	0.070 [0.056]	0.144 [0.085]	0.018 [0.177]
DD*White	-0.131 [0.090]	-0.214 [0.234]	-0.087 [0.062]	-0.094 [0.086]	-0.128 [0.189]
DD*Black	-0.155 [0.112]	-0.017 [0.258]	-0.140** [0.069]	-0.060 [0.108]	-0.195 [0.196]
DD*Asian	-0.403*** [0.124]	-	-	-0.285** [0.121]	-
DD*Hispanic	-0.090 [0.084]	-0.320 [0.260]	-0.050 [0.068]	-0.063 [0.086]	0.000 [0.177]
No. of observations	4992	1001	4325	4593	974

***1% significance level; **5% significance level. Clustered robust standard errors are reported in parentheses

Notes: Current refers to both daily and occasional smokers combined. The 'DD' estimates are equal to the β_2 coefficients, while the 'DD*race/ethnicity' estimates are equal to the β_3 coefficients from equation 2. These coefficients are jointly significant. The blank results are due to there not being enough observations for a particular subset of our sample.

Black=Black/African American; Hispanic=Hispanic/Latinx.

3.5. Discussion

One of the most perplexing findings from this paper is that Hispanic/Latinx women in the low educational attainment group smoked more frequently as a result of the public-place bans (Table 3.2). A possible explanation is that since other members of the household are barred from smoking at bars and other indoor venues, they may be smoking more at their own homes. This means that public-place smoking bans may have the unintended consequence of displacing smoking to private places, as suggested by Adda and Cornaglia (2010) and Ho et al. (2010). As a result of the displacement, Hispanic/Latinx women could be more exposed to the

smoking culture at home than previously, and thus less likely to abstain from smoking. As mentioned in the literature review, past studies have looked at Hispanic/Latino smoking risks due to parental and peer influence (Livaudais et al., 2007; McCleary-Sills et al., 2010). They find a positive link between spousal smoking and women's decision to initiate smoking or return to smoking after having quit, as well as a reduced probability of quitting (Cobb et al., 2014; Homish & Leonard, 2005). Related to this, another possible explanation for why Hispanic/Latinx women may be failing to quit smoking even knowing that they are pregnant may be due to acculturation. Studies have shown that Hispanic/Latinx women (compared to men) are more likely to take up smoking with American acculturation, which reduces family cohesion and relaxes negative attitudes toward smoking that are usually more rigid in traditional Hispanic families (Flores et al., 2018; Lorenzo-Blanco & Cortina, 2013). Thus, our hypothesis is that public-place bans displace smoking to private homes, so Hispanic/Latinx women take up smoking (or smoke more frequently) as a result of increased exposure and the decrease in the associated stigma due to increased acculturation. This hypothesis is somewhat corroborated by the results shown in Figure 3.2, which shows that Hispanic/Latinx women in the low educational attainment group were more likely to be former smokers (i.e. to have quit) compared to the base. However, these women may be relapsing and smoking more frequently when the bans are displacing smoking to their homes. To be clear, this possible displacement is only affecting women who were already occasional smokers, so it is not too far-fetched to hypothesize that the increased exposure to smoking due to displacement is over-riding their intention (if any) of quitting. This may be exacerbated by their being in the low education category and thus having less knowledge about the harmful effects of smoking during pregnancy (Higgins et al., 2009).

In contrast to this, we see no evidence of increased smoking behavior among any racial/ethnic subgroup in our high educational attainment group (Table 3.3). In fact, we see declining smoking behavior among Black/African American and Asian women, and no change among Hispanic/Latinx women. One plausible explanation for this Hispanic/Latinx contrast between low and high educational attainment group may be that the former group has greater knowledge about the negative effects of smoking during pregnancy (Higgins et al., 2009; Kandel et al., 2009). This effect may be trumping the effect of increased exposure and acculturation.

3.6. Limitations

A limitation of this study is that respondents were only identifiable at the state level. In some instances, public-place smoking bans had already been implemented in certain. As a result, our findings are likely understating the effect of the bans. Another limitation is that we do not have information on women's level of knowledge regarding the harmful effects of smoking during pregnancy. We also did not have enough Asian pregnant women in our sample to carry out regression analysis for all five of the models.

Information regarding the stage of their pregnancy and at what stage they changed their smoking behavior (if they did) was also unavailable. In available, this would have allowed us to do more robustness checks. Similarly, data on use of or preference for smoking cessation programs would have improved the model. Finally, we did not have information on the smoking behavior of other household members. This would have allowed us to test some of our conjectures about the unexpected findings for Hispanic/Latinx women.

CHAPTER 4

CONCLUSIONS

The two studies presented here look at the effect of public-place smoking bans on different outcomes related to risky health behavior, by racial/ethnic heterogeneity. This research was motivated by the need to better understand the impact of the bans by race/ethnicity and to show that merely looking at the average effects can mask the differential impacts.

In chapter 2, we assessed how public-place smoking bans affected four drinking-related outcomes across racial/ethnic subgroups. We found that Black/African American and Hispanic/Latinx men generally experienced improvements in the drinking-related outcomes as a result of the bans. Women on the other hand had mixed results, with estimates indicating that the number of drinks consumed by women increased due to the ban. However, there were improvements in the ‘number of binge drinking occasions’ outcome for Black/African women.

In chapter 3, we assessed how public-place smoking bans affected five smoking-related outcomes for pregnant women across different racial/ethnic subgroups, by educational attainment. The results show that Black/African American and Asian women from the high education group were more likely to successfully quit smoking (i.e. become ‘former’ smokers) as a result of the bans. However, a perplexing result is that Hispanic/Latinx women in the low education group were more likely to increase their frequency of smoking (i.e. went from occasional to daily smokers) as a result of the bans.

If we are to assess the bigger picture presented by these two chapters, we need to first figure out whether a policy such as the public-place smoking ban is worth implementing in the first place. We know from prior research that taxation usually works better than bans if policy makers want to curb smoking behavior (Adda & Cornaglia, 2010; Chaloupka & Grossman, 1996; Nonnemaker & Farrelly, 2011). However, while it is reasonable to assume that public place smoking bans are implemented primarily to reduce second-hand smoke exposure, any incidental decrease in smoking behavior among smokers must also be taken into account while assessing the efficacy of such policies. So, even though our research does not analyze the effect of the ban on second-hand smoke exposure, we have shown that the bans have had direct impact on smoking behavior (among pregnant women) and even indirect impacts on drinking behavior. It is important to take these incidental effects of policies into account as it helps paint a more holistic picture, thereby helping policymakers make better decisions. Past research has mostly looked at the effect of public-place smoking bans on smoking behavior for the population as a whole, and have concluded that there was little or no effect. As a result, policy makers have perhaps under-valued the benefits of the policy. However, and perhaps unsurprisingly, any assessments looking at the effect of large scale policies have a tendency to mask socio-economic differentials. This is often due to the policy impacting certain groups of people differently, which means that while it might be leading to improvements in some, it might be causing a decline for others. As we see from our analysis, there are also some conflicting evidence showing the policy improving outcomes for some groups while causing an unwanted deterioration among a few groups. This interesting, albeit unexpected result is

possibly the main takeaway from this research as this goes to show the importance of analyzing large scale policies at the disaggregate level.

Going forward, there are further scopes of evaluating this ban. For instance, one concern that plagues these public-place bans is that it might be leading to displacement of smoking to private places such as cars and houses. While most studies (as mentioned in our literature review) do not find this to be the case, we would recommend that future studies looking at smoking displacement do so at a disaggregate level. There is some opposition to the enactment of bans because some feel that the bans may hurt local businesses and employment through reductions in sales in bars and restaurants as smokers go out to these places less. While evidence have shown this this not to be the case (Shafer, 2017; Kayani et al., 2012), it is still crucial to analyze all aspects of such policies.

In the future, it is expected that smoking ban policies will extend into the private domain as well (e.g. vehicles and housing buildings) and these might be met with resistance. Public health advocates also consider smokeless tobacco products (such as e-cigarettes) as the next challenge. These e-cigarettes, while not as harmful as tobacco based cigarettes, are still a public-health concern as particulate matters from these products are still injurious to the user's and by-standers' health (Hyland et al., 2012). Research surrounding the health impact of e-cigarettes has been gaining wide traction lately and as of July 2019, twenty states in the U.S. have banned e-cigarettes in places that also have 100% smoking bans in place (ANRF, 2019). The takeaway from our research can also be implemented in the assessment of policies targeting reductions in e-cigarette smoking and other smokeless tobacco products.

Given the advent of new forms of nicotine delivery, the regulatory environment is also likely to change and adapt with time. Smoking bans will continue to expand into new territories and policy makers will need continued feedback from researchers in order to formulate new policies. As such, our contribution to this ongoing effort is significant because we believe future researchers should pay more attention to the racial/ethnic differentials in policy. More effort also needs to be made to explore why certain races/ethnicities are more receptive than others when it comes to the bans. This would allow policy makers to formulate more targeted and thus more effective smoking cessation policies in the future.

REFERENCES

- Adams, E. K., Melvin, C. L., Raskind-Hood, C., Joski, P. J., & Galactionova, E. (2011). Infant delivery costs related to maternal smoking: an update. *Nicotine & Tobacco Research*, 13(8), 627-637.
- Adams, S., & Cotti, C. (2008). Drunk driving after the passage of smoking bans in bars. *Journal of Public Economics*, 92(5-6), 1288-1305.
- Adda, J., & Cornaglia, F. (2010). The effect of bans and taxes on passive smoking. *American Economic Journal: Applied Economics*, 2(1), 1-32.
- Agrawal, A., Scherrer, J. F., Grant, J. D., Sartor, C. E., Pergadia, M. L., Duncan, A. E., Madden, P. A., Haber, J. R., Jacob, T., & Bucholz, K. K. (2010). The effects of maternal smoking during pregnancy on offspring outcomes. *Preventive Medicine*, 50(1-2), 13-18.
- Ahern, J., Galea, S., Hubbard, A., Midanik, L., & Syme, S. L. (2008). "Culture of drinking" and individual problems with alcohol use. *American Journal of Epidemiology*, 167(9), 1041-1049.
- Akuete, K., Oh, S. S., Thyne, S., Rodriguez-Santana, J. R., Chapela, R., Meade, K., Rodriguez-Cintrón, W., LeNoir, M., Ford, J. G., & Williams, L. K. (2011). Ethnic variability in persistent asthma after in utero tobacco exposure. *Pediatrics*, peds. 2011-0640.
- Al-Sahab, B., Saqib, M., Hauser, G., & Tamim, H. (2010). Prevalence of smoking during pregnancy and associated risk factors among Canadian women: a national survey. *BMC Pregnancy and Childbirth*, 10(1), 24.
- Alegria Margarita, Canino Glorisa, Shrout Patrick E, Woo Meghan, Duan Naihua, Vila Doryliz, Torres Maria, Chen Chihnan, & Meng Xiao Li. (2008). Prevalence of mental illness in immigrant and non-immigrant US Latino groups. *American Journal of Psychiatry*, 165(3), 359-369.
- Almond, D., & Currie, J. (2011). Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives*, 25(3), 153-172.
- American Psychological Association. (2013). Ethnic and Racial Minorities & Socioeconomic Status. Retrieved August 15, 2018, from <http://www.apa.org/pi/ses/resources/publications/minorities.aspx>
- Anger, S., Kvasnicka, M., & Siedler, T. (2011). One last puff? Public smoking bans and smoking behavior. *Journal of Health Economics*, 30(3), 591-601.
- ANRF. (2019). States and Municipalities with Laws Regulating Use of Electronic Cigarettes: American Nonsmoker's Rights Foundation. <https://no-smoke.org/wp-content/uploads/pdf/ecigslaws.pdf>

- ANSRF. (2018). Summary of 100% Smokefree State Laws and Population Protected by 100% U.S. Smokefree Laws. Retrieved September 2017, from American Nonsmoker's Rights Foundation <https://no-smoke.org/wp-content/uploads/pdf/SummaryUSPopList.pdf>
- Anthony, J. C., & Echeagaray-Wagner, F. (2000). Epidemiologic analysis of alcohol and tobacco use. *Alcohol Research & Health*, 24(4), 201-201.
- Barrett, S. P., Tichauer, M., Leyton, M., & Pihl, R. O. (2006). Nicotine increases alcohol self-administration in non-dependent male smokers. *Drug and Alcohol Dependence*, 81(2), 197-204.
- Been, J. V., Mackay, D. F., Millett, C., Pell, J. P., Van Schayck, O. C., & Sheikh, A. (2015). Impact of smoke-free legislation on perinatal and infant mortality: a national quasi-experimental study. *Scientific Reports*, 5.
- Bernat, D. H., Maldonado-Molina, M., Hyland, A., & Wagenaar, A. C. (2013). Effects of smoke-free laws on alcohol-related car crashes in California and New York: time series analyses from 1982 to 2008. *American Journal of Public Health*, 103(2), 214-220.
- Braun, J. M., Daniels, J. L., Kalkbrenner, A., Zimmerman, J., & Nicholas, J. S. (2009). The effect of maternal smoking during pregnancy on intellectual disabilities among 8-year-old children. *Paediatric and Perinatal Epidemiology*, 23(5), 482-491.
- BRFSS. (2002). Overview: BRFSS 2002. In Centers for Disease Control and Prevention (CDC) (Ed.). Atlanta, Georgia: CDC.
- BRFSS. (2011). Overview: BRFSS 2011. In Centers for Disease Control and Prevention (CDC) (Ed.). Atlanta, Georgia: CDC.
- Caetano, R., Ramisetty-Mikler, S., & Rodriguez, L. A. (2008). The Hispanic Americans Baseline Alcohol Survey (HABLAS): Rates and predictors of alcohol abuse and dependence across Hispanic national groups. *Journal of Studies on Alcohol and Drugs*, 69(3), 441-448.
- Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics using Stata, revised edition* (Vol. 2): Stata press College Station, TX.
- Carpenter, C., Postolek, S., & Warman, C. (2011). Public-place smoking laws and exposure to environmental tobacco smoke (ETS). *American Economic Journal: Economic Policy*, 3(3), 35-61.
- CDC. (2014). 2014 Surgeon General's Report: The Health Consequences of Smoking—50 Years of Progress. 2019, from https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm
- CDC. (2019). Fast Facts. Retrieved 28 April, 2019, from https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/index.htm
- Chae, D. H., Takeuchi, D. T., Barbeau, E. M., Bennett, G. G., Lindsey, J. C., Stoddard, A. M., & Krieger, N. (2008). Alcohol disorders among Asian Americans: associations with unfair treatment, racial/ethnic discrimination, and ethnic identification (the national Latino

- and Asian Americans study, 2002–2003). *Journal of Epidemiology & Community Health*, 62(11), 973-979.
- Chaloupka, F. J., & Grossman, M. (1996). Price, tobacco control policies and youth smoking: National Bureau of Economic Research.
- Chartier, K., & Caetano, R. (2010). Ethnicity and health disparities in alcohol research. *Alcohol Research & Health*, 33(1-2), 152.
- Claire Churchard, & Townshend, G. (2017, 19 June 2017). A breath of fresh air: how the smoking ban has changed the pub trade, *The Morning Advertiser*.
- Cnattingius, S. (2004). The epidemiology of smoking during pregnancy: smoking prevalence, maternal characteristics, and pregnancy outcomes. *Nicotine & Tobacco Research*, 6(Suppl_2), S125-S140.
- Cobb, L. K., McAdams-DeMarco, M. A., Huxley, R. R., Woodward, M., Koton, S., Coresh, J., & Anderson, C. A. (2014). The association of spousal smoking status with the ability to quit smoking: the Atherosclerosis Risk in Communities Study. *American Journal of Epidemiology*, 179(10), 1182-1187.
- Corrigall, W. A., Coen, K. M., & Adamson, K. L. (1994). Self-administered nicotine activates the mesolimbic dopamine system through the ventral tegmental area. *Brain research*, 653(1-2), 278-284.
- CTCA. (2018). Double trouble: Tobacco and alcohol combine to elevate cancer risk. from <https://www.cancercenter.com/community/blog/2018/06/double-trouble-tobacco-and-alcohol-combine-to-elevate-cancer-risk>
- Curtin, S. C., & Matthews, T. J. (2016). Smoking Prevalence and Cessation Before and During Pregnancy: Data From the Birth Certificate, 2014. In National Vital Statistics Reports (Ed.), (1 ed., Vol. 65). Hyattsville: National Center for Health Statistics.
- Decker, S. L., & Schwartz, A. E. (2000). Cigarettes and alcohol: substitutes or complements? : National Bureau of Economic Research.
- Ellickson, P. L., Orlando, M., Tucker, J. S., & Klein, D. J. (2004). From adolescence to young adulthood: racial/ethnic disparities in smoking. *American Journal of Public Health*, 94(2), 293-299.
- England, L. J., Kim, S. Y., Shapiro-Mendoza, C. K., Wilson, H. G., Kendrick, J. S., Satten, G. A., Lewis, C. A., Whittern, P., Tucker, M. J., & Callaghan, W. M. (2012). Maternal smokeless tobacco use in Alaska Native women and singleton infant birth size. *Acta Obstetrica et Gynecologica Scandinavica*, 91(1), 93-103.
- English, K. C., Merzel, C., & Moon-Howard, J. (2010). Translating public health knowledge into practice: Development of a lay health advisor perinatal tobacco cessation program. *Journal of Public Health Management and Practice*, 16(3), E9-E19.

- Fagan, A. A., Wright, E. M., & Pinchevsky, G. M. (2014). The protective effects of neighborhood collective efficacy on adolescent substance use and violence following exposure to violence. *Journal of Youth and Adolescence*, 43(9), 1498-1512.
- Falk, D. E., Yi, H.-Y., & Hiller-Sturmhofel, S. (2006). An epidemiologic analysis of co-occurring alcohol and tobacco use and disorders: findings from the National Epidemiologic Survey on Alcohol and Related Conditions. *Alcohol Research & Health*, 29(3), 162-172.
- Fitzgerald, E. M. (2012). Evidence-based tobacco cessation strategies with pregnant Latina women. *Nursing Clinics*, 47(1), 45-54.
- Flores, R. T., Cano, M. Á., Correa-Fernández, V., Field, C. A., Heppner, W. L., Strong, L. L., & Castro, Y. (2018). Associations of multiple acculturation domains with smoking status among Latino adults. *Journal of Latina/o Psychology*.
- Freeman, D. G. (2000). Alternative panel estimates of alcohol demand, taxation, and the business cycle. *Southern Economic Journal*, 325-344.
- Funk, D., Marinelli, P. W., & Le, A. D. (2006). Biological processes underlying co-use of alcohol and nicotine: neuronal mechanisms, cross-tolerance, and genetic factors. *Alcohol Research & Health*, 29(3), 186-193.
- Gallet, C. A., & Eastman, H. S. (2007). The impact of smoking bans on alcohol demand. *The Social Science Journal*, 44(4), 664-676.
- Gallup. (2014). Smoking and Drinking in America Today. Retrieved May 10, 2019, from <https://news.gallup.com/opinion/polling-matters/176420/smoking-drinking-america-today.aspx>
- Gilman, S. E., Breslau, J., Subramanian, S., Hitsman, B., & Koenen, K. C. (2008). Social factors, psychopathology, and maternal smoking during pregnancy. *American Journal of Public Health*, 98(3), 448-453.
- Glasgow, R. E., Whitlock, E. P., Eakin, E. G., & Lichtenstein, E. (2000). A brief smoking cessation intervention for women in low-income planned parenthood clinics. *American Journal of Public Health*, 90(5), 786.
- Gubner, N. R., Delucchi, K. L., & Ramo, D. E. (2016). Associations between binge drinking frequency and tobacco use among young adults. *Addictive Behaviors*, 60, 191-196.
- Hasin, D. S., Stinson, F. S., Ogburn, E., & Grant, B. F. (2007). Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry*, 64(7), 830-842.
- Heaman, M. I., & Chalmers, K. (2005). Prevalence and correlates of smoking during pregnancy: A comparison of aboriginal and non-aboriginal women in Manitoba. *Birth*, 32(4), 299-305.

- Higgins, S. T., Heil, S. H., Badger, G. J., Skelly, J. M., Solomon, L. J., & Bernstein, I. M. (2009). Educational disadvantage and cigarette smoking during pregnancy. *Drug and Alcohol Dependence*, 104, S100-S105.
- Ho, S. Y., Wang, M. P., Lo, W. S., Mak, K. K., Lai, H. K., Thomas, G. N., & Lam, T. H. (2010). Comprehensive smoke-free legislation and displacement of smoking into the homes of young children in Hong Kong. *Tobacco Control*, 19(2), 129-133.
- Homish, G. G., & Leonard, K. E. (2005). Spousal influence on smoking behaviors in a US community sample of newly married couples. *Social Science & Medicine*, 61(12), 2557-2567.
- Hyland, A., Barnoya, J., & Corral, J. E. (2012). Smoke-free air policies: past, present and future. *Tobacco Control*, 21(2), 154-161.
- Hyland, A., Higbee, C., Hassan, L., Fong, G. T., Borland, R., Cummings, K. M., & Hastings, G. (2007). Does smoke-free Ireland have more smoking inside the home and less in pubs than the United Kingdom? Findings from the international tobacco control policy evaluation project. *European Journal of Public Health*, 18(1), 63-65.
- IPFS. List of ethnic enclaves in North American cities. Retrieved 5 August, 2019, from https://ipfs.io/ipfs/QmXoypizjW3WknFiJnKLwHCnL72vedxjQkDDP1mXWo6uco/wiki/List_of_ethnic_enclaves_in_North_American_cities.html
- Iceland, J., & Sharp, G. (2013). White residential segregation in US metropolitan areas: Conceptual issues, patterns, and trends from the US census, 1980 to 2010. *Population Research and Policy Review*, 32(5), 663-686.
- Jamal, A., Homa, D. M., O'Connor, E., Babb, S. D., Caraballo, R. S., Singh, T., Hu, S. S., & King, B. A. (2015). Current cigarette smoking among adults—United States, 2005–2014. *Morbidity and Mortality Weekly Report*, 64(44), 1233-1240.
- Johnson, P. B., Boles, S. M., Vaughan, R., & Kleber, H. D. (2000). The co-occurrence of smoking and binge drinking in adolescence. *Addictive Behaviors*, 25(5), 779-783.
- Jones, A. M., Laporte, A., Rice, N., & Zucchelli, E. (2015). Do public smoking bans have an impact on active smoking? Evidence from the UK. *Health Economics*, 24(2), 175-192.
- Kandel, D. B., Griesler, P. C., & Schaffran, C. (2009). Educational attainment and smoking among women: risk factors and consequences for offspring. *Drug and Alcohol Dependence*, 104, S24-S33.
- Kasza, K. A., McKee, S. A., Rivard, C., & Hyland, A. J. (2012). Smoke-free bar policies and smokers' alcohol consumption: findings from the International Tobacco Control Four Country Survey. *Drug and Alcohol Dependence*, 126(1-2), 240-245.
- Kayani, N., Cowan, S. R., Homan, S. G., Wilson, J., Warren, V. F., & Yun, S. (2012). Peer Reviewed: Economic Effect of Smoke-Free Ordinances on 11 Missouri Cities. *Preventing Chronic Disease*, 9.

- King, T. K., Borrelli, B., Black, C., Pinto, B. M., & Marcus, B. H. (1997). Minority women and tobacco: implications for smoking cessation interventions. *Annals of Behavioral Medicine*, 19(3), 301-313.
- Koh, H. K., Oppenheimer, S. C., Massin-Short, S. B., Emmons, K. M., Geller, A. C., & Viswanath, K. (2010). Translating research evidence into practice to reduce health disparities: a social determinants approach. *American Journal of Public Health*, 100(S1), S72-S80.
- Koxsal, A., & Wohlgenant, M. K. (2016). How do smoking bans in restaurants affect restaurant and at-home alcohol consumption? *Empirical Economics*, 50(4), 1193-1213.
- Kotz, D., & West, R. (2008). Explaining the social gradient in smoking cessation: it's not in the trying, but in the succeeding. *Tobacco Control*, tc. 2008.025981.
- Lambe, M., Hultman, C., Torráng, A., MacCabe, J., & Cnattingius, S. (2006). Maternal smoking during pregnancy and school performance at age 15. *Epidemiology*, 524-530.
- Lasser, K., Boyd, J. W., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H. (2000). Smoking and mental illness: a population-based prevalence study. *Jama*, 284(20), 2606-2610.
- Lee, J.-M. (2007). The synergistic effect of cigarette taxes on the consumption of cigarettes, alcohol and betel nuts. *BMC Public Health*, 7(1), 121.
- Livaudais, J. C., Napoles-Springer, A., Stewart, S., & Kaplan, C. P. (2007). Understanding Latino adolescent risk behaviors: parental and peer influences. *Ethnicity and Disease*, 17(2), 298.
- Lorenzo-Blanco, E. I., & Cortina, L. M. (2013). Towards an integrated understanding of Latino/a acculturation, depression, and smoking: A gendered analysis. *Journal of Latina/o Psychology*, 1(1), 3.
- Lumley, J., Oliver, S., Chamberlain, C., & Oakley, L. (2004). Interventions for promoting smoking cessation during pregnancy. *Cochrane Database of Systematic Reviews*(4).
- Maimon, D., & Browning, C. R. (2012). Underage drinking, alcohol sales and collective efficacy: Informal control and opportunity in the study of alcohol use. *Social Science Research*, 41(4), 977-990.
- Markowitz, S., Adams, E. K., Dietz, P. M., Tong, V. T., & Kannan, V. (2013). Tobacco control policies, birth outcomes, and maternal human capital. *Journal of Human Capital*, 7(2), 130-160.
- Markowitz, S., Kaestner, R., & Grossman, M. (2005). An investigation of the effects of alcohol consumption and alcohol policies on youth risky sexual behaviors. *American Economic Review*, 95(2), 263-266.

- McCleary-Sills, J. D., Villanti, A., Rosario, E., Bone, L., & Stillman, F. (2010). Influences on tobacco use among urban Hispanic young adults in Baltimore: findings from a qualitative study. *Progress in Community Health Partnerships: Research, Education, and Action*, 4(4), 289.
- Miller, D. P., Villa, K. F., Sivapathasundaram, D., & Hogue, S. L. (2001). Birth and first-year costs for mothers and infants attributable to maternal smoking. *Nicotine & Tobacco Research*, 3(1), 25-35.
- Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2005). Correction: actual causes of death in the United States, 2000. *Jama*, 293(3), 293-294.
- Mulia, N., Ye, Y., Greenfield, T. K., & Zemore, S. E. (2009). Disparities in alcohol-related problems among White, Black, and Hispanic Americans. *Alcoholism: Clinical and Experimental Research*, 33(4), 654-662.
- National Center for Health Statistics. (2012). Health, United States, 2011: With special feature on socioeconomic status and health.
- National Highway Traffic Safety Administration (NHTSA). (2010). Alcohol and highway safety: special report on race/ethnicity and impaired driving In N. H. T. S. Administration (Ed.), *Traffic Tech* (Vol. 398). Washington, DC: US Department of Transportation.
- NIAAA. (2015). Alcohol Facts and Statistics. from <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/alcohol-facts-and-statistics>
- Nonnemaker, J. M., & Farrelly, M. C. (2011). Smoking initiation among youth: The role of cigarette excise taxes and prices by race/ethnicity and gender. *Journal of Health Economics*, 30(3), 560-567.
- NSDUH. (2014). Results from the 2013 National Survey on Drug Use and Health: Summary of national findings. *NSDUH Series H-48, HHS Publication No.(SMA) 14-4863*.
- Oken, E., Levitan, E., & Gillman, M. (2008). Maternal smoking during pregnancy and child overweight: systematic review and meta-analysis. *International Journal of Obesity*, 32(2), 201.
- Owyang, M. T., & Vermann, E. K. (2012). Where there's a smoking ban, there's still fire. *Federal Reserve Bank of St. Louis Review*(July/August 2012).
- Picone, G. A., Sloan, F., & Trogon, J. G. (2004). The effect of the tobacco settlement and smoking bans on alcohol consumption. *Health Economics*, 13(10), 1063-1080.
- Pierani, P., & Tiezzi, S. (2009). Addiction and interaction between alcohol and tobacco consumption. *Empirical Economics*, 37(1), 1-23.
- Reeves, R., Rodrigue, E., & Kneebone, E. (2016). Five evils: Multidimensional poverty and race in America. *Economic Studies at Brookings Report*.
- Reitsma, M. B., Fullman, N., Ng, M., Salama, J. S., Abajobir, A., Abate, K. H., Abbafati, C., Abera, S. F., Abraham, B., & Abyu, G. Y. (2017). Smoking prevalence and attributable disease

- burden in 195 countries and territories, 1990–2015: a systematic analysis from the Global Burden of Disease Study 2015. *The Lancet*, 389(10082), 1885-1906.
- Rose, J. E., Brauer, L. H., Behm, F. M., Cramblett, M., Calkins, K., & Lawhon, D. (2004). Psychopharmacological interactions between nicotine and ethanol. *Nicotine & Tobacco Research*, 6(1), 133-144.
- Ruhm, C. J. (1996). Alcohol policies and highway vehicle fatalities. *Journal of Health Economics*, 15(4), 435-454.
- Ruhm, C. J., Jones, A. S., McGeary, K. A., Kerr, W. C., Terza, J. V., Greenfield, T. K., & Pandian, R. S. (2012). What US data should be used to measure the price elasticity of demand for alcohol? *Journal of Health Economics*, 31(6), 851-862.
- Sacks, J. J., Gonzales, K. R., Bouchery, E. E., Tomedi, L. E., & Brewer, R. D. (2015). 2010 national and state costs of excessive alcohol consumption. *American Journal of Preventive Medicine*, 49(5), e73-e79.
- Saha, T. D., Chou, S. P., & Grant, B. F. (2006). Toward an alcohol use disorder continuum using item response theory: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychological Medicine*, 36(7), 931-941.
- Salihu, H. M., Aliyu, M. H., Pierre-Louis, B. J., & Alexander, G. R. (2003). Levels of excess infant deaths attributable to maternal smoking during pregnancy in the United States. *Maternal and Child Health Journal*, 7(4), 219-227.
- Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 277(5328), 918-924.
- Shafer, P. (2017). Impact of US smoke-free air laws on restaurants and bars by employer size: a panel study. *BMJ Open*, 7(11), e018137.
- Sharma, R., Lodhi, S., Sahota, P., & Thakkar, M. M. (2015). Nicotine administration in the wake-promoting basal forebrain attenuates sleep-promoting effects of alcohol. *Journal of Neurochemistry*, 135(2), 323-331.
- Smedberg, J., Lupattelli, A., Mårdby, A.-C., & Nordeng, H. (2014). Characteristics of women who continue smoking during pregnancy: a cross-sectional study of pregnant women and new mothers in 15 European countries. *BMC Pregnancy and Childbirth*, 14(1), 213.
- Söderpalm, B., Ericson, M., Olausson, P., Blomqvist, O., & Engel, J. A. (2000). Nicotinic mechanisms involved in the dopamine activating and reinforcing properties of ethanol. *Behavioural Brain Research*, 113(1-2), 85-96.
- Substance Abuse and Mental Health Services Administration (SAMHSA). (2018). Results from the 2017 national survey on drug use and health: Detailed tables. In Substance Abuse and Mental Health Services Administration (Ed.), (pp. 798). Maryland: SAMHSA.
- Tauchmann, H., Lenz, S., Requate, T., & Schmidt, C. M. (2013). Tobacco and alcohol: complements or substitutes? *Empirical Economics*, 45(1), 539-566.

- Tauras, J. A., Huang, J., & Chaloupka, F. J. (2013). Differential impact of tobacco control policies on youth sub-populations. *International Journal of Environmental Research and Public Health*, 10(9), 4306-4322.
- Tax Foundation. (2019). State Sales, Gasoline, Cigarette, and Alcohol Tax Rates by State, 2000-2014. Retrieved February 12, 2019, from <https://taxfoundation.org/state-sales-gasoline-cigarette-and-alcohol-tax-rates/>
- Tweedie, N. (2007, 23 August 2007). After the smoking ban- the bars that emptied, *The Telegraph*.
- United States Department of Health & Human Services (USDHHS). (2014). 2014 Surgeon General's Report: The Health Consequences of Smoking-50 Years of Progress. In Centers for Disease Control and Prevention (Ed.): United States Department of Health & Human Services.
- Washio, Y., & Cassey, H. (2016). Systematic review of interventions for racial/ethnic-minority pregnant smokers. *Journal of Smoking Cessation*, 11(1), 12-27.
- Williams, D. R., Mohammed, S. A., Leavell, J., & Collins, C. (2010). Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. *Annals of the New York Academy of Sciences*, 1186(1), 69-101.
- Xu, X., Bishop, E. E., Kennedy, S. M., Simpson, S. A., & Pechacek, T. F. (2015). Annual healthcare spending attributable to cigarette smoking: an update. *American Journal of Preventive Medicine*, 48(3), 326-333.
- Young-Wolff, K. C., Kasza, K. A., Hyland, A. J., & McKee, S. A. (2014). Increased cigarette tax is associated with reductions in alcohol consumption in a longitudinal US sample. *Alcoholism: Clinical and Experimental Research*, 38(1), 241-248.
- Young, D. J., & Bielinska-Kwapisz, A. (2003). Alcohol consumption, beverage prices and measurement error. *Journal of Studies on Alcohol*, 64(2), 235-238.

APPENDIX

Table A.1. The marginal effects of the ban, low educational attainment.

	Low educational attainment				
	Current versus Former	Daily versus Occasional	Occasional versus Former	Daily versus Former	Attempted to quit
DD	0.025 [0.129]	-0.181 [0.164]	0.096 [0.134]	-0.084 [0.143]	0.159 [0.150]
White	-0.030 [0.074]	0.145 [0.118]	-0.156 [0.086]	0.020 [0.068]	-0.234*** [0.073]
DD*White	0.044 [0.134]	0.085 [0.149]	0.008 [0.123]	0.121 [0.139]	0.012 [0.149]
Black	-0.106 [0.085]	-0.050 [0.126]	-0.096 [0.102]	-0.113 [0.077]	-0.068 [0.076]
DD*Black	-0.014 [0.145]	0.181 [0.177]	-0.080 [0.135]	0.096 [0.143]	0.170 [0.162]
Asian	0.106 [0.212]	0.438** [0.197]	-0.246 [0.157]	0.188 [0.196]	-0.058 [0.092]
DD*Asian	-0.329 [0.299]	0.027 [0.290]	-0.177 [0.244]	-0.194 [0.285]	-
Hispanic	-0.315*** [0.091]	-0.014 [0.136]	-0.251** [0.107]	-0.301*** [0.078]	-0.084 [0.109]
DD*Hispanic	0.132 [0.169]	0.339** [0.142]	-0.085 [0.138]	0.280 [0.153]	-0.259 [0.178]
No. of observations	3,218	1,512	2,112	2,778	1,504

***1% significance level; **5% significance level. Clustered robust standard errors are reported in parentheses

Notes: Current refers to both daily and occasional smokers combined. The 'DD' estimates are equal to the β_2 coefficients, while the 'DD*race/ethnicity' estimates are equal to the β_3 coefficients from equation 2. These coefficients are jointly significant. The blank results are due to there not being enough observations for a particular subset of our sample.

Black=Black/African American; Hispanic=Hispanic/Latinx.

Table A.2. The marginal effects of the bans, high educational attainment.

	High educational attainment				
	Current versus Former	Daily versus Occasional	Occasional versus Former	Daily versus Former	Attempted to quit
DD	0.161 [0.084]	0.377 [0.248]	0.070 [0.056]	0.144 [0.085]	0.018 [0.177]
White	0.131** [0.062]	0.031 [0.134]	0.076 [0.052]	0.088 [0.047]	0.063 [0.159]
DD*White	-0.131 [0.090]	-0.214 [0.234]	-0.087 [0.062]	-0.094 [0.086]	-0.128 [0.189]
Black	0.141 [0.074]	-0.177 [0.137]	0.114 [0.062]	0.048 [0.054]	0.196 [0.145]
DD*Black	-0.155 [0.112]	-0.017 [0.258]	-0.140** [0.069]	-0.060 [0.108]	-0.195 [0.196]
Asian	0.135 [0.071]	0.214 [0.285]	0.043 [0.086]	0.130 [0.073]	0.015 [0.300]
DD*Asian	-0.403*** [0.124]	-	-	-0.285** [0.121]	-
Hispanic	0.022 [0.063]	0.032 [0.185]	0.018 [0.062]	-0.003 [0.051]	0.013 [0.155]
DD*Hispanic	-0.090 [0.084]	-0.320 [0.260]	-0.050 [0.068]	-0.063 [0.086]	0.000 [0.177]
No. of observations	4,992	1,001	4,325	4,593	9,74

***1% significance level; **5% significance level. Clustered robust standard errors are reported in parentheses

Notes: Current refers to both daily and occasional smokers combined. The 'DD' estimates are equal to the β_2 coefficients, while the 'DD*race/ethnicity' estimates are equal to the β_3 coefficients from equation 2. These coefficients are jointly significant. The blank results are due to there not being enough observations for a particular subset of our sample.

Black=Black/African American; Hispanic=Hispanic/Latinx.

BIOGRAPHY OF THE AUTHOR

Muntasir Rahman was born in Khulna, Bangladesh on May 2, 1993. Muntasir graduated from European Standard High School in 2011 and attended East West University in Dhaka, Bangladesh where he completed an undergraduate and master's degree in economics in 2016. While a student at EWU, Muntasir was an active member of the university debate team and represented his school at various national and international tournaments. During his master's, he also worked full-time for Parkway Hospitals Singapore Pvt. Ltd and later at the James P Grant School of Public Health as a researcher.

Aside from academics, Muntasir likes travelling and immersing himself in the customs and traditions of different cultures. His collection of fiction novels and music are his solace. In addition, he is an avid cook and loves to experiment with different cuisines and ingredients. He loves to play basketball and squash.

Muntasir enrolled in the School of Economics at the University of Maine in the fall of 2017 and worked as a research assistant to Dr. Angela Daley. During his time at UMaine, he has attended multiple domestic and international workshops and conferences. Muntasir is a candidate for the Masters of Science degree in Economics from the University of Maine in August 2019.